

MODERN Machine Shop

HOWARD CAMPBELL, Editor

Volume 11

August, 1938

Number 3

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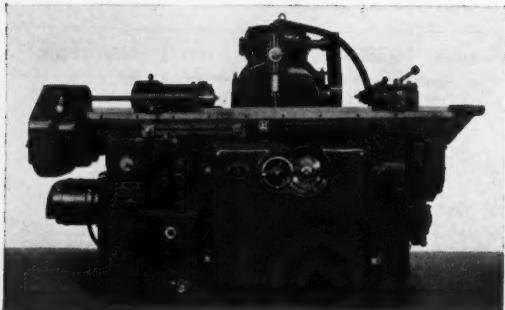
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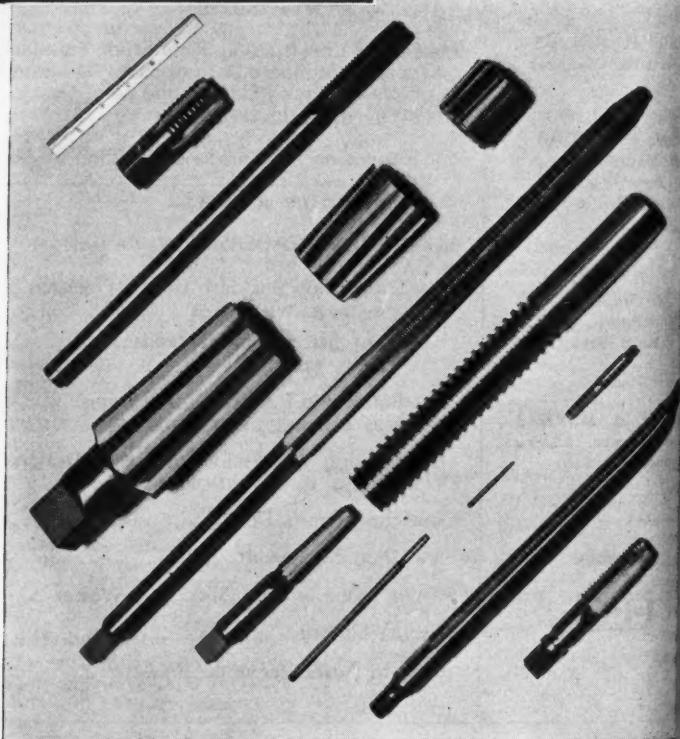
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MODERN Machine Shop

CINCINNATI, OHIO

AUGUST, 1938

VOL. 11, No. 3

Economical Die Casting Production at Mt. Vernon Plant

In this article the author takes the reader on a trip through a die casting plant where modern equipment and efficient methods are the order of the day.

BY BARTLETT WEST

RODUCTION of die castings in both zinc and aluminum alloys is attained with rather unusual economy in the plant of the Mt. Vernon Die Casting Corporation, Mt. Vernon, N. Y., and for several reasons. In the first place, the plant operates with a rather low overhead. The greater part of the plant is new and well equipped, but without expensive refinements. Second, the dies employed are made within the plant and this is done directly from the customer's drawing of the part and without the delay and expense of making drawings of the dies, the toolmakers being experienced in working in this manner.

In the third place—and highly im-

portant from an economy standpoint—about 80 per cent of the dies built are of the so-called "unit" type, designed for use in multiples of two or four at a time in the same machine. Reasons for this will shortly appear. Fourth, die-casting machines are designed for a high output, yet are moderate in cost, being made to the company's own designs and with the die-moving portions more or less interchangeable. All machines accommodate unit dies and are used with these invariably except when the die required is too large to fit a unit frame.

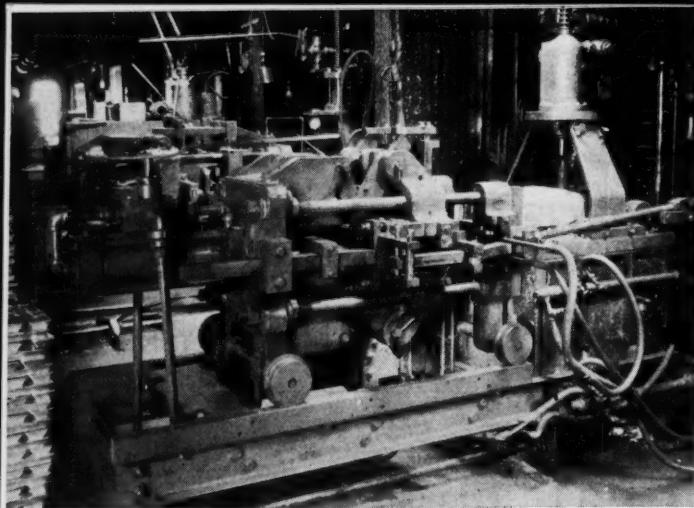
Finally, the layout and machine tools employed for fin removal and whatever machining is required are

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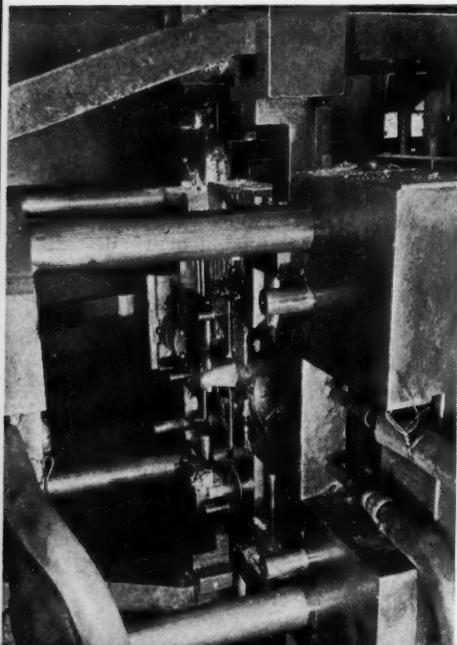
such as to handle this work at low cost. Cleaning tools are made to go with each casting die and, like the latter, are produced without making drawings and whenever possible include more or less standard parts.

For some years the entire plant was housed in a two-story and basement building which now includes chiefly offices on the upper floor, a tool room on the first floor, and in the basement

Some of the machinery employed in die casting zinc alloy, showing the heavy top gate and the hydraulic cylinder for operating them, at left, adjacent to the pilot casting ingots, and, at right, the final casting with air-operated plunger above.

today is quite new, is all on one floor and is equipped with a saw-tooth roof affording excellent light. This floor has an area of 18,000 square feet and a larger part of three sides is devoted to the casting machines. The machines are set with the furnaces against the wall and the axes of the machines run at right angles to the walls, movable shields being placed between the machines together with benches on which the operators place the castings as they are produced.

From these benches, helpers take the castings and, if light enough, break off the sprues and gates by hand. The castings are heavy, band or circular saws placed near the machines are employed to cut off the gates and sprues. In some instances an air press is placed close to the casting machine to shear small castings from a gate, several at a time. Castings partly cleaned are placed in tote boxes to be passed in the general direction of the center section of the floor.



Looking into a four-unit die in one of the zinc die-casting machines where portions of the core pulling mechanism can be seen as well as the gates leading to each of four dies.

One of our machines shows a four-unit frame cylinder, a brake pipe, other or master cylinder, hour-glass, goose-neck, in raised in normal this re-submerged metal before each made, whi

the machine in die casting alloy, the heavy top two gates from a four-unit die, showing both faces of the castings as they come from the die shown in the preceding illustration. This indicates the variety of castings produced in one shot by the machine and shows some of the core work on the castings.

where other cleaning and some machining is done. The fourth side of the room is devoted chiefly to

the precision machining required on some castings, usually lathe work, the plus sensitive drilling and tapping.

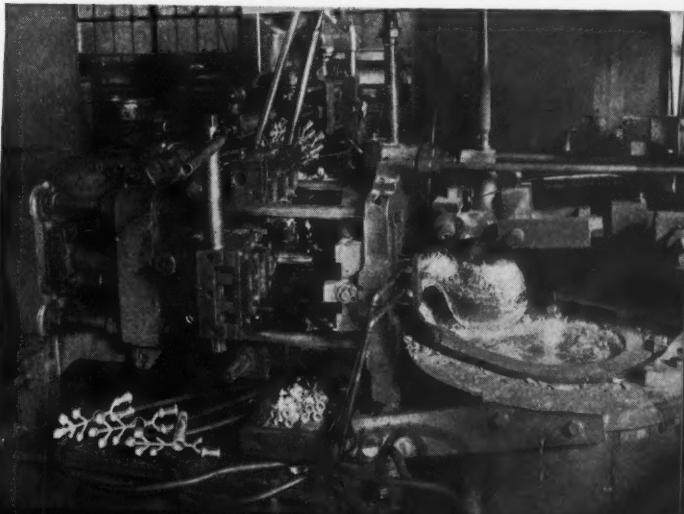
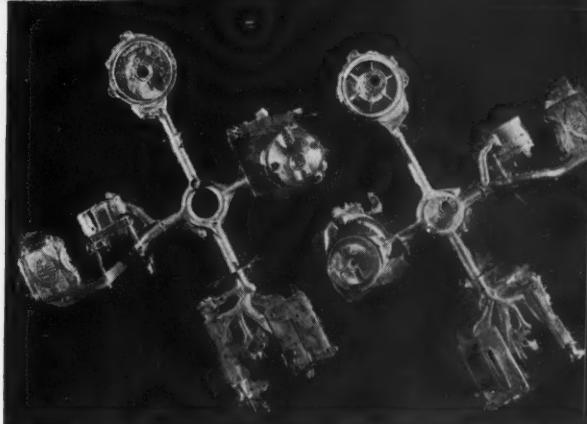
In one corner of the plant, occupying a separate room, is a melting department where alloys are prepared and cast into ingots in molds arranged in a chain conveyor. Metal is ladled from the furnace into the molds as they move slowly toward the discharge station. By the time they reach this point, the ingots have solidified and are automatically ejected, loaded onto trucks, and subsequently delivered, as required, to the respective casting machines. There they are stacked at points convenient to the machine operators, who feed the ingots into the melting furnace of each machine as needed. All sprues and

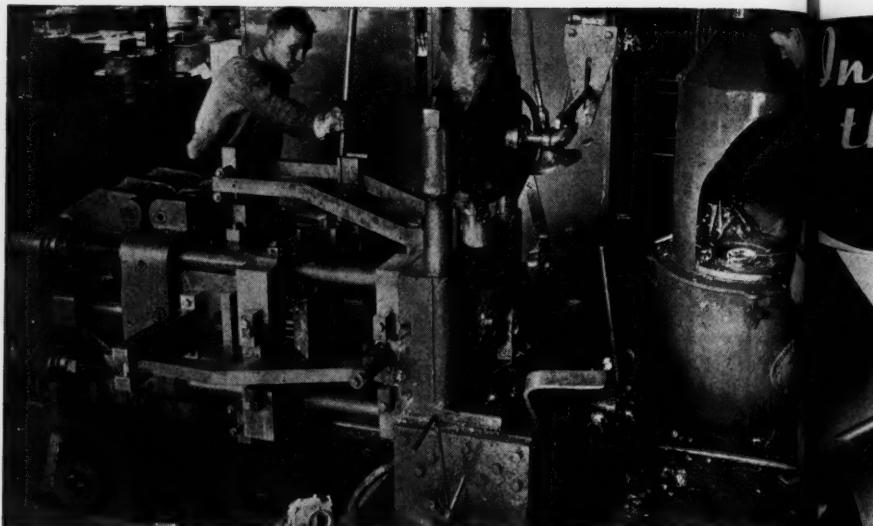
gates broken from castings are remelted in special equipment.

As in nearly all die-casting shops, the largest output, by far, is in zinc alloy. In this plant, Zamak 3 (meeting A. S. T. M. No. 23 specification) is used exclusively. Aluminum alloys are made to customer specifications, but in general are in standard A. S. T. M. alloys, although some other alloys can be cast in the special high-pressure machine designed for making particularly dense aluminum castings demanded chiefly for aircraft applications. The aluminum alloy most used is A. S. T. M. No. VII, which is 4 per cent copper, 4½ per cent silicon, balance aluminum.

All of the casting machines use hydraulically operated pistons acting

One of the low-pressure machines for die casting aluminum shown with dies open and fixed in a two-unit frame. One of these dies casts five cylindrical hydraulic brake pistons and the other one casts two master pistons of hour-glass shape. The cooseneck is shown in raised position, but in normal operation this remains nearly submerged in molten metal until just before each shot is made, when, of course, the dies are closed.





High-pressure machine for die casting aluminum. Semi-molten metal is ladled from the furnace at the right into the cylinder below the vertical hydraulic ram. The latter then lowered, forcing most of the metal into the die, shearing the gate and subsequently pushing out the remaining slug of aluminum.

through toggle mechanisms for opening, closing and locking the dies. The front half of the die is fixed and the rear half slides on the tie bars which take the clamping pressure. In general design, so far as die motion and locking are concerned, all the machines are practically the same, though varying in size and in total locking pressure produced. However, three different methods of metal injection are employed and there are corresponding differences in the design of the metal-melting end of the machines as well as in the arrangement of the mechanisms for metal-handling within the machine. All, however, employ oil in the furnaces for melting the metal and gas for keeping it at a substantially uniform temperature for each alloy used.

In the zinc machines, of which there are seven in all, the metal is forced into the die by a $2\frac{1}{2}$ -in. plunger actuated by a 4-in. air cylinder served

by a 350-lb. air line, hence the metal enters the dies under about 900 per sq. in. pressure. The return stroke of the plunger is by a spring compressed on the down stroke. In all but one of the aluminum machines, a direct air pressure of 450 lb. per sq. in. is applied directly on the surface of the molten metal in a gooseneck, as most aluminum machines, except the a gooseneck smaller than the average is used and the method of moving a gooseneck into contact with the die differs somewhat from that used in machines of other design. A positive plunger cannot be used with molten aluminum, and this necessitates a gooseneck construction.

To provide higher pressure than is feasible with air acting directly on the aluminum, resort is had to a special form of machine in which, instead of using molten aluminum, a supply of semi-molten or plastic form is ladled into a vertical injection cylinder pro-

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to each "shot" of the machine. A plunger, hydraulically operated, is then forced into the cylinder and in turn forces most of the charge through a horizontal sprue hole into the die, which has previously been closed and locked as in other machines.

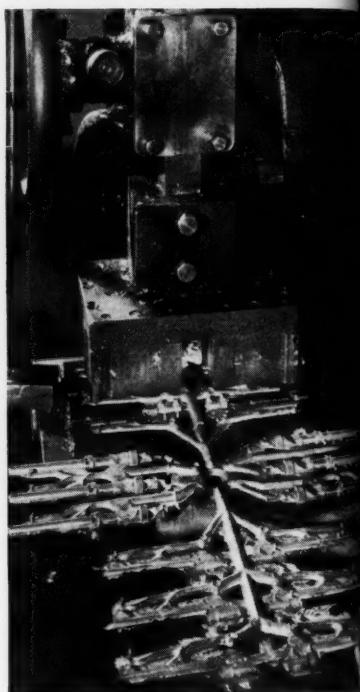
The bottom of the injection cylinder is closed by a second hydraulic ram, acting upward and serving as a cushion. This ram is raised and locked before the charge is ladled into the machine. A slug, representing a certain necessary excess of metal over that forced into the die, remains above the lower plunger. After the shot, the lower plunger is dropped and the upper one is used to force the slug down a short distance until it comes opposite a gate, whence it is pushed out and subsequently remelted.

The chief advantage of this type of aluminum machine is that it subjects the metal to a pressure of about 8,000 lb. per sq. in. and thereby produces a denser casting than that obtained from the type of machine used previously. Another advantage is that the metal, being somewhat cooler than molten aluminum, does not heat-check the dies so rapidly and a somewhat smoother casting, on the average, may result. In addition, alloys which cannot be die cast in a gooseneck machine can be used, including those of magnesium and brass.

The chief disadvantage is that the rate of production is lower, about 65 to 70 shots an hour, as against about 100 to 110 shots an hour with the gooseneck type and around 285 to 300 shots an hour with the zinc machines. In addition, an extra man to ladle the metal into the machine is needed, whereas the gooseneck and the zinc machines are operated by one man. For most aluminum castings, however, the gooseneck machine is entirely adequate, even though the pressure is lower than on the zinc and on the

high-pressure aluminum machine.

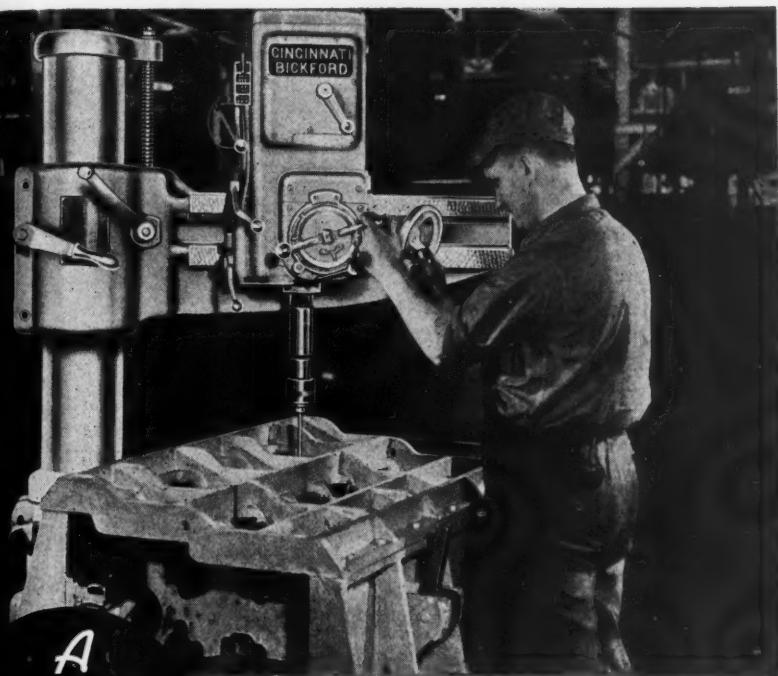
Of special significance in this as previously indicated, is the "unit" dies which all machines designed to accommodate. The dies are merely rather small either six inches or eight in square, designed to fit into a



Arbor press with six-cavity cleaning die which the rough flash is cut from sixings at the same time as these are seen from the gate. A gate from a four-die is shown in the press.

aridized frame which holds in instances two dies, but in one machine four dies. Some of these frames to be seen in accompanying illustrations with the dies in place. Their advantage lies in the fact that, at each close or "shot" of the machine, either two or four dies are filled simultaneously as against one in a "normal" machine.

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A
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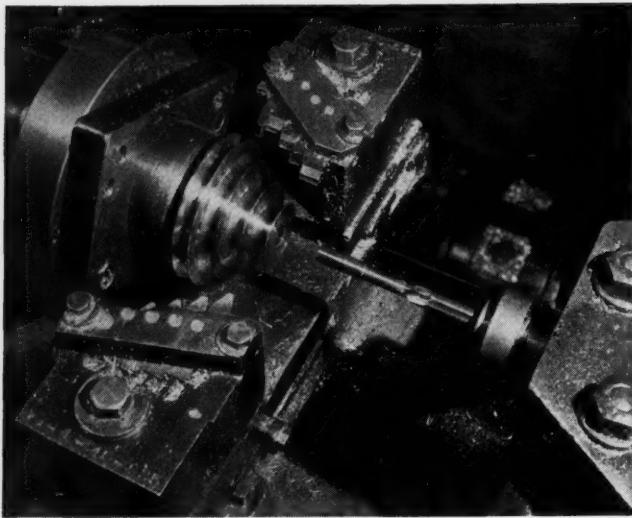
*... but already on the job
reaming and tapping
at Caterpillar Tractor Co.*

The machine shown—one of 11 of this size and type in a modern tractor plant—is reaming holes and tapping holes in straight side of 4 cylinder 3 1/4" bore tractor cylinder blocks. The column of the drill which is 7 1/2" diameter, is mounted directly on the fixture.

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OAKLEY CINCINNATI OHIO U.S.A.



Turret lathe with cutters on and back of the slide for machining the grooves and of a step V-belt pulley. In the turn a reamer for finishing the hub hole. The free end of the reamer pilots in the bushing in the stock.

as usually set up. Although in this shop the unit dies are confined within the dimensions indicated, these are found adequate for a large proportion of the output.

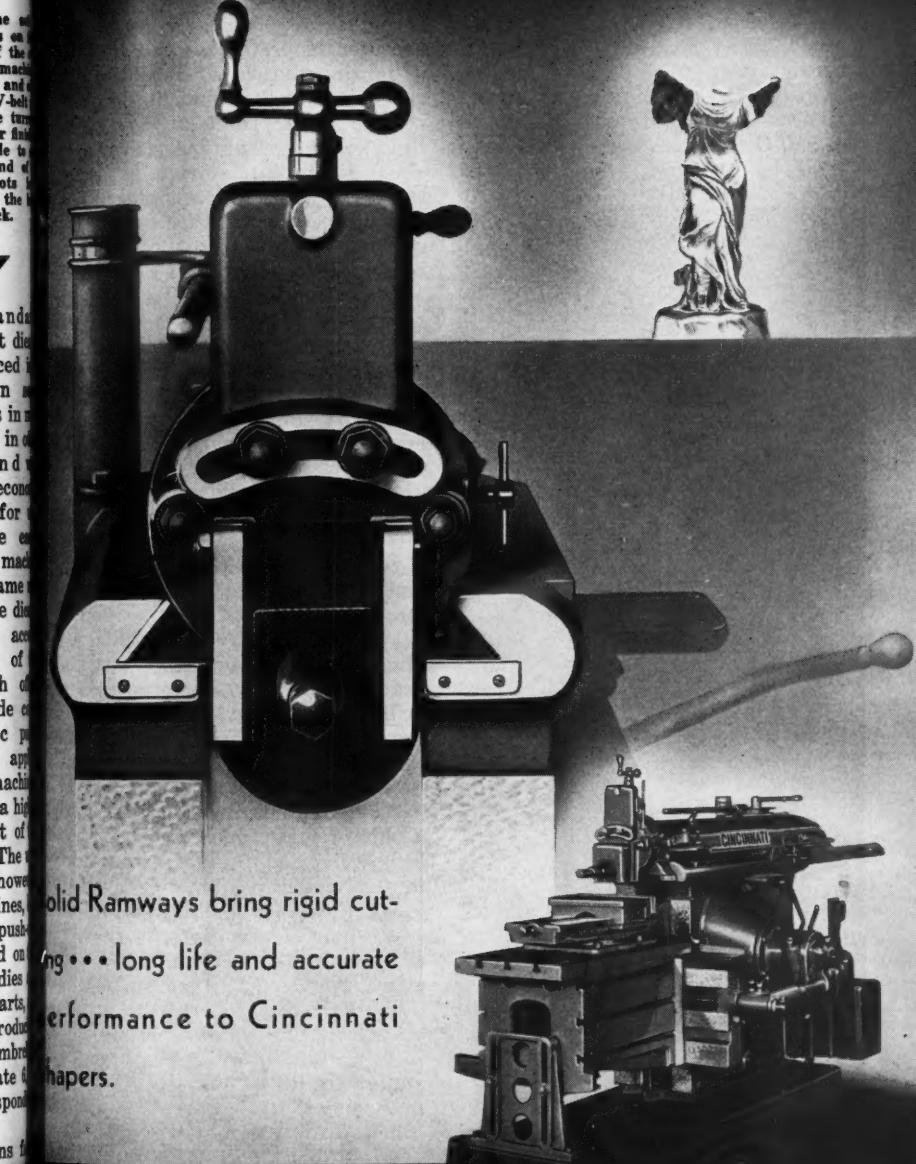
Unit dies are small and are quite easy to handle and to shift into and out of the frames in the machine, making the set-up time short. Frames have a central sprue from which a gate leads to each die. The locations and sizes of main gates are uniform, and provision for pulling side cores from as many as three sides and bottom, if required, is made. If orders are not such as to call for running the full complement of dies in each frame, the space is readily blanked off, but by specializing in such dies and having on hand at this date a large variety for many different customers, the frames are usually run full and a correspondingly large and economical output is secured.

Unit dies are not confined, of course, to single cavities. In many cases multiple cavities are used either for duplicate or for different parts. When a part is too large to be made in one of

and quickly removed from the machine when not required and the same machine can be used for separate dies.

As will be observed from accompanying illustrations, many of these machines are equipped with side bars designed to operate side pins automatically, and automatic pull-out pins are also used. This applies particularly to the zinc machines which have been developed to a high point because so large a part of production is in zinc alloys. The die is applied on aluminum, however, as well as on the zinc machines, hand-operated cores and push pins are more frequently used on aluminum machines. Many dies are made with interchangeable parts, for example, in the die for producing the sliding sleeve for beach umbrellas, which is made to accommodate 10 or 12 ribs, as is the corresponding tip fitting.

Equipment for cleaning fins on die castings is similar to that in plants. The most common form of cleaning is the shaving process through which the casting is forced



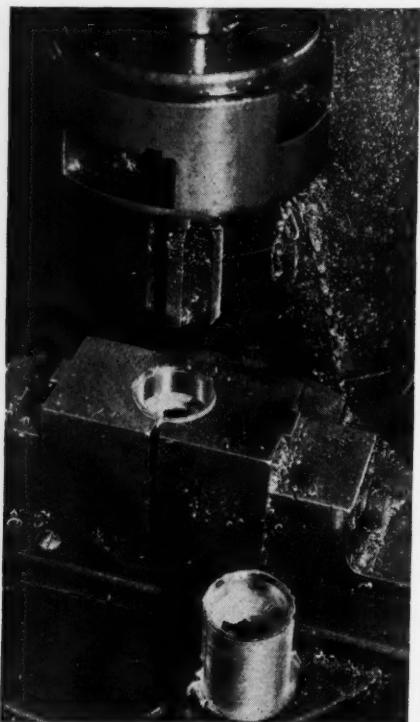
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order to shear off the fins at some contour. These dies are used in kick, arbor or power punch presses, depending on the size of casting and on the thickness and length of fin to be sheared. Cored holes are often cleared of fins by punching, of course, and



Fixture used for holding a thin-wall cylindrical die casting while it is being tapped inside with a special thread. Swinging the handle to the position shown clamps the work securely. Moving it to the left causes the jaws to open and free the work, the jaws being operated by cam slots on a horizontal disk attached to the handle.

some holes which are more economically punched than cored are so produced. This applies especially to zinc castings, which are high in impact strength and lend themselves to punching operations if properly supported in the die or fixture.

One instance in which punched holes are used in preference to coring is a lighting fixture so designed that circular central portion is punched to receive either three or five pendant light outlets. The holes, which are about $1\frac{1}{4}$ in. in diameter, are symmetrically spaced and are punched separately in a dial fixture on which the casting is indexed around as required to obtain the number of holes needed.

In another instance, a hand-operated arbor press placed near the casting machine is used to shear fins from the parts of a patented hair curling device. These are produced in a six-cavity unit dies, all of which are run in the same machine at the same time, producing a gate of 24 castings. The cleaning die has six cavities and is used to do a rough cleaning operation on 12 of the 24 castings, six at a time, cutting these from the gate and shearing most of the fin at each stroke of the press.

Many castings require drilling, tapping, threading or other operations that are readily performed in the drill press. When the design of the press is such that the casting may be positively and accurately positioned, the work is often held in a partially standardized fixture having a pair of jaws which are reciprocating in opening and closing and are locked in the closed position by the action of a central disk having a central hole and a pair of cam slots in which pins slide as the disk is turned by the operating lever.

Some turning operations are done on special light lathes in which the tools are moved by quick-acting links and levers rather than by screw-operated slides. In other cases, turning lathes are used to advantage, as in turning and boring multiple work groove pulleys. In one such set-up, a Warner & Swasey turret lathe, a set of tools on the slide machines

(Continued on page 82)

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Cost of Welding

Concluding Section of

Paper read by

E. W. P. SMITH

Consulting Engineer,

The Lincoln Electric Company

At the Semi-annual Meeting of
American Society of Mechanical En-
gineers, June 23, 1938.

A COMBINATION of the consumption rate and speed (data taken from actual tests) shows some interesting commercial results. Take for comparison two electrodes of the following characteristics and test results:

Size	$\frac{1}{4}$	$\frac{1}{4}$
Amperes	340	340
Volts	34	34
Arc K. W.	11.56	11.56
Eff. Generator	59.5%	59.5%
Coating, % in		
14 in.	22.2	20.1
Wt. electrode		
used	1.60 lb.	1.56 lb.
Wt. stub ends	.231	.386
Electrode used	1.369	1.174
Wt. plate —		
deposit	15.860 lb.	15.790 lb.
Wt. plate	14.915	14.940
Wt. Deposit	.945	.850
Time	7.867 min.	5.916 min.
Per cent loss	30.94	27.55
Dep. Lb. per Hr.		
(.945	(.850	
$\frac{.945}{7.867} \times 60$	$= 7.22$	$\frac{.850}{5.916} \times 60 = 8.62$

The welding metal deposited was comparable:

Yield Point 51,100 53,100
Tensile 64,800 65,100

Elongation 2" 19.9 23.1

It is more or less obvious that a higher rate of deposition is preferred but the full effect of this on the cost is not readily realized unless the cost is calculated on the basis of a certain amount of metal such as 10,000 lbs.

Labor \$1.00 per hour
Power02 " k.w.h.
Electrode085 per lb.
Operation factor 50%

Then time in hours to deposit:

$\frac{10,000}{10,000 \text{ lbs.}} = \frac{10,000}{7.22 \times .50} = 27$

$\frac{10,000}{8.62 \times .50} = 23$

K.W.H. to deposit 1 lb. is:
 $\frac{11.56}{11.56} = 1$

$\frac{.595 \times 7.22}{.595 \times 7.22} = 1$

$\frac{11.56}{11.56} = 1$

$\frac{.596 \times 8.62}{.596 \times 8.62} = 1$

Add 10% to results to take account of idling losses.

Power for 10,000 lbs = 29,600 K.W.H.
24,800 K.W.H.

Electrode required =

$$\frac{10,000}{.6906} = 14,480 \text{ lbs.}$$

$$\frac{10,000}{.7245} = 13,800 \text{ lbs.}$$

summation:

	Hours to		
deposit 10,000..	2770	2320	
K.W.H.	29,600	24,800	
Electrode Lbs.	14,480	13,800	
COSTS			
Labor	\$2770.00	\$2320.00	
Power	592.00	496.00	
Material	1231.00	1175.00	
	\$4593.00	\$3991.00	
Cost	\$3991.00		
Reduction ..	602.00		
	\$602.00		
	$\frac{602.00}{10,000}$	= 6 cents per	
		10,000	10,000
		10,000	10,000

Six cents per lb. deposited is about $\frac{1}{4}$ cents per lb. purchased, which is a very considerable item — 50% of the purchase price of the electrode.

The deposition of metal involves use of power and it is with this item we are next concerned. Power is supplied by welding generators, driven usually by an electric motor, and this kind of set will be used in illustrating power costs.

In selecting a generator, in order to keep costs down the most modern generator available should be used. The curves show test results made on generators of different sizes, and the results are proof positive of the economy of using a modern generator. (See Fig. 10).

As a demonstration of the above general statement the following actual test data is presented:

Length Weld

	896 Inches.	40 Volt Gen. New	25 Volt Gen. Old
Actual Welding			
Time—Min.	126.3	177.6	
K.W.H. input			
per seam	22.3	24.8	
Power Cost 100			
inches weld	\$.020	\$.022	
Inches Weld			
per Rod	7.7	6.6	

Next is the selection of the size of the generator. To do this it is necessary to know the application; that is, the size and types of points and plate thicknesses, not only as to dimension

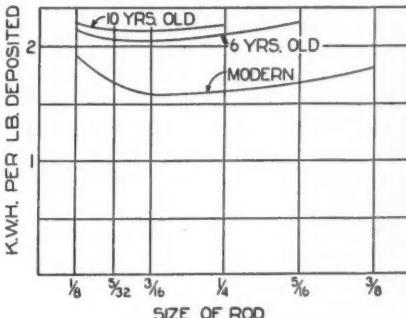
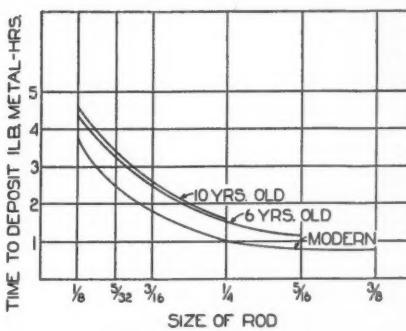


Fig. 10—Chart showing comparisons of time necessary to deposit one pound of metal, for old and new machines.

but also the percentage of total shop production for each. These plate thicknesses can be expressed in terms of welding as arc-amperes.

It is obvious that generators of dif-

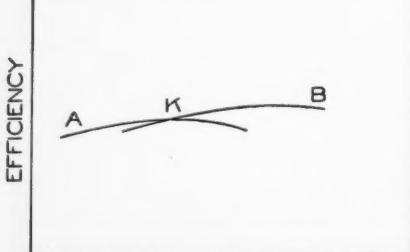


Fig. 11—Chart of Efficiency Curves

ferent sizes have different efficiency curves and that these curves cross. (See Fig. 11.) If the greater part of the work is done to right of K, then B or larger size is used as it is the most efficient. It is well to recall here that large electrodes result in reduced costs and larger electrodes require higher currents which are obtained at higher efficiencies.

In calculating power costs, efficiency is the governing item and the larger electrodes operating on a larger machine result in operation at a point of high efficiency. It is necessary, however, that this efficiency be that at the arc voltage and amperes. Usually efficiencies are given at 40 volts. For example:

Amps. 120 200 300 400 500
Eff.

40V. 60% 64% 65% 64% 61%
Usual

Arc
Volts 25 28 32 37 40

If the efficiencies are known at 25 volts as well then an operating efficiency curve may be plotted. (See Fig. 12.)

Another curve of interest and use

is a curve on deposition.

Assuming $\frac{3}{4}$ Deposition factor
100% Operating Factor

Then from Table A (Page 60, J. issue)

Amperes 110 130 150 250 325 400

Deposit Lbs.
per Hr.

(100%

Operating

Factor) 1.74 2.2 2.64 5 7.14 11
(See Fig. 13)

Some very interesting and useful facts can be obtained by combining this last curve and the tabulation given.

If the 25 volt efficiencies are known the efficiencies at arc voltages may be calculated approximately as follows:

Amperes 120 200 300 400
K.W. Output

at 40V. 4.8 8. 12 16

Eff. 40V. (%) 60 64 65 64

K.W. Input

at 40V. 8.0 12.5 18.4 25

Arc Volts 25 28 32 37

(40-Arc
Volts)

..... x Amps. 1.8 2.4 2.4 1.2
1000

K.W. Input at

Arc Volts 6.2 10.1 16 23.8

The K.W. input at arc voltage is the desired factor and there is no

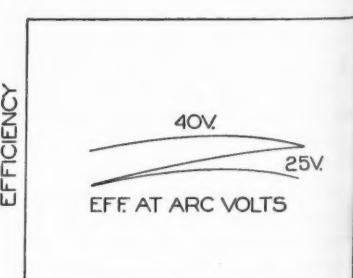


Fig. 12—Chart showing how efficiency is plotted when voltage (in this case 25V) is known.

WIDER RANGE

of Set-Up

with a Superpower Magnetic Chuck



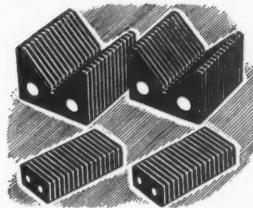
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New Magnetic
V-Blocks
and *Parallels*



These tools extend work-range in grinding or machining irregular-shaped parts. They carry the chuck's magnetic power well above face plate level. Applicable to any style or model of chuck. Stocked in these sizes:

T-P Magnetic Parallels	T-P Magnetic <i>V-Blocks</i>
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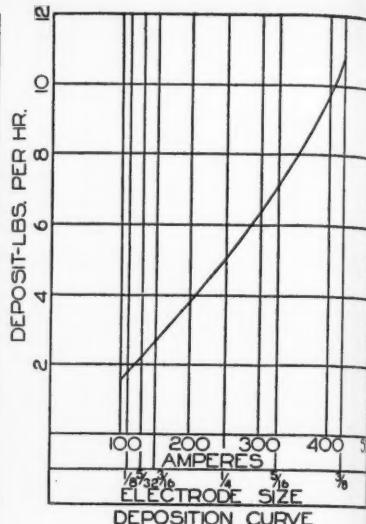
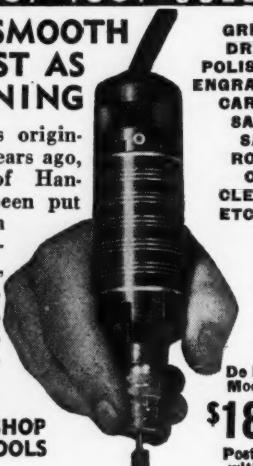


Fig. 13—Deposition Curve

to calculate efficiency in per cent			
Ampères	120	200	300
K.W. input (arc volts) ..	6.2	10.1	16
Lbs. deposited ..	2	3.8	6.4
Lbs. purchased ..	3	5.7	9.6
K.W.H. lb. pur. 2.07	1.78	1.68	

Cost power (Cents—at 2c K.W.H.) ..			
12.4	20.2	32	
Cost electrode (8 1/2c lb.) ..			
25.5	48.5	81.5	

Total cost (elec.
and power) .. 37.9 68.7 113.5

If the costs are plotted against amperes (arc) then the curves shown on Fig. 14 are obtained. The labor charge is the hourly labor rate divided by the operating factor, or it may be labor charge plus overhead, so the total obtained is the cost per hour of operation. These are added to the curves for electrode and power as shown.

Then for any arc ampere, as

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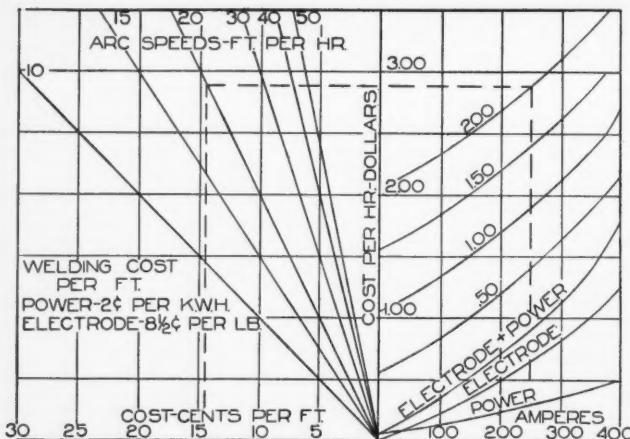


Fig. 14—Chart welding costs per foot, based on per cost, electrode & labor rate, and operating factor.

example 250 amperes with labor at \$1.00 per hour, operating factor 50%, the labor item = \$2.00 ($1.00 \div 50\%$). For an arc speed of 20 feet per hour the cost is obtained by starting at 250 amperes — going to the labor items marked \$2.00, horizontally to the arc speed curve, and down to cost per foot, 14.5¢. Position, type of joint, deposition efficiency, all govern speed. If, therefore, the total cost of operation is divided by the speed all factors are accounted for.

For individual use in specific cases, this can be further simplified. Suppose power and electrode figures are as given above 2¢ per K.W.H. and 8½¢ per lb., labor is \$1.00 per hour and operating factor is 66-2/3%. Labor item is then \$1.50. Our tabulation then becomes:

Amperes	120	200	300	400
Elec. +				
power cost	37.9	68.7	113.5	172.4
Labor Item	150	150	150	150

Total 187.9 218.7 263.5 322.4

Instead of plotting as in previous curve, the amperes and the cost scale are plotted together and we have one scale — amperes to get directly the cost per foot (See Fig 15). These

three items—
labor, Electro-
Power, are
basic ones
welding costs.

But even these
are influenced
and may influence
the final or final

ing treatment. Such treatment may be as simple as painting or nameplating. Painting involves accessibility, which may be a matter of preparation.

Stress relieving and/or heat treatment may mean special consideration in preparation and handling; question of collapse or deformation when metal is soft; how to support a part; provision for escape of gases. There must be no completely enclosed part; otherwise the expansion of the part would cause deformations. All these must be given careful thought and their interrelation thoroughly studied.

This final treatment or finishing process is related to preparation, method of handling of joints or assemblies and these in turn affect labor, electrode and material costs.

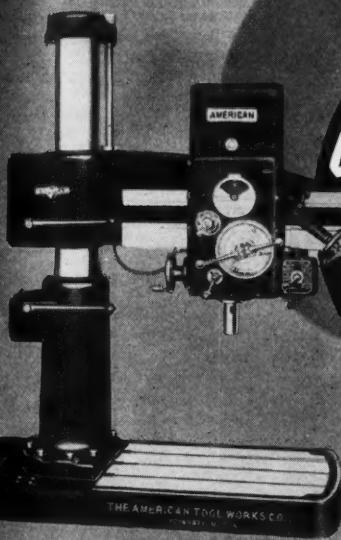
Welding costs are reduced by (1) use of larger machines which are more efficient than smaller ones, and (2) use of large electrodes which deposit metal of high quality and high durability. This large electrode results in less tendency toward distortion. The use of large generators and large electrodes produces, therefore, well-constructed improved quality at low costs. And when quality

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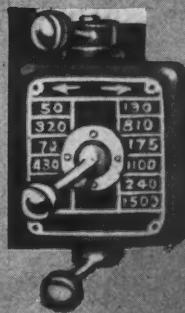
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The Hole Wizard speed change is direct reading—2 levers—one ball shift and one 2-position back gear lever on the 12-speed and only one ball shift lever on the 9-speed machine.

Simply throw the lever or levers to the selected speed shown on the plate—that's all there is to it.

The bottom lever shown on the illustration is the motor control lever (directly under the speed control lever—the most convenient place for it) which starts, stops and reverses the spindle.

On work requiring frequent speed changes the Hole Wizard holds a tremendous advantage.



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INSTANTANEOUS
Speed Control

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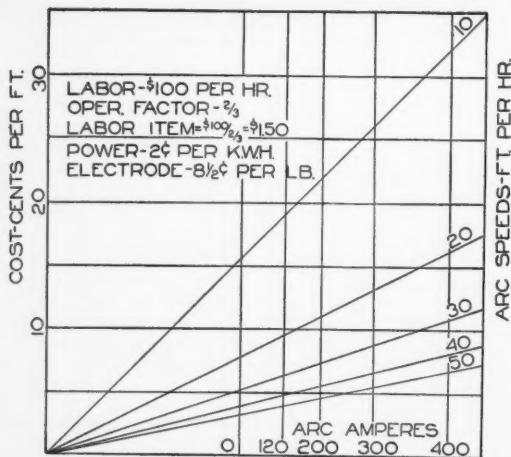


Fig. 15—Chart of welding costs, in which the amperes and cost scale are plotted together.

up and cost goes down can more be required of a process? Arc welding does just that.

"Theory of Vibration Control." Owners, operators and builders of industrial machinery will undoubtedly be interested in the paper entitled "Theory of Vibration Control" which was presented by Mr. S. Rosenzweig, President of The Korfund Company, before the American Society of Mechanical Engineers at their Dallas meeting on June 7, 1938. This comprehensive treatise covers the subject of machinery vibration transmission and its elimination both from a theoretical and practical standpoint. It is profusely illustrated with photographs, engineering drawings and sketches which indicate clearly all important points discussed in the text. In addition to explaining the types and applications of anti-vibration products, the paper describes in detail the most recent developments in this field.

Printed copies of the paper are available upon request to The Korfund Company, 48-15 Thirty-Second Place, Long Island City, New York.

"Work Done on the Blanchard." This attractive, well-illustrated booklet presents more than 100 typical examples of the machining and finishing of flat surfaces by Blanchard Grinding. In nearly every instance the job shown is merely

one of many similar jobs. The booklet is divided into sections, each section being devoted to examples of work done on particular Blanchard machines.

A copy of the booklet may be sent to any mechanical executive who will address a request to The Blanchard Machine Co., 62 State St., Cambridge, Massachusetts.

Inland Ledloy. This four-page folder, designated as Bulletin No. 50, describes Ledloy, a product of Inland Steel Co., 38 S. Dearborn St., Chicago Ill. Ledloy is a lead-beam open hearth free cutting steel which is said to combine the good qualities of open hearth steel with the economy of machinability. "Ledloy" is Inland's copyrighted name for steel of any composition in which lead has been alloyed and in which the lead is uniformly dispersed throughout the steel. Copy free upon request.

B & S Nos. 20 and 22 Plain Grind Machines are governed electrically, to a large part automatically, by simple controls which are grouped at the front of the machine. The machines are compact, powerful production units having a full range of headstock spindle movements and cross feeds, and are designed for both traversing and plunge-cut grinding. An outstanding feature is that once the machine has been set for a given job, it can be controlled entirely by the cross feed hand wheel.

Complete information covering these machines is given in a folder published by Brown & Sharpe Mfg. Co., Providence, R. I. Copy free upon request.

"How to Join and Repair Pipe the Quick, Easy, Permanent Way" is the title of a 12-page bulletin which provides helpful information on the construction and maintenance of pipe lines. Dresser Pipe Couplings for joining of new lines and Dresser Repair Clamps and Repair Sleeves for the repair of old lines are fully described. The use of "before and after" pictures is a feature of the booklet—a publication of the S. R. Dresser Manufacturing Co., Bradford, Pa. Copy free.

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Method of Constructing Time Standard Data at East Pittsburgh

The first section of an article explaining how formulas and tables of standard data for constructing time studies can be developed from standard elemental time values.

TO derive operating time allowances solely from time studying every operation performed on each type of item that has to be processed would be too tedious and too costly wherever job shop quantities constitute the major portion of an establishment's activities.

This fact was realized by the Westinghouse Electric and Manufacturing Company's Time Study Department twenty-five years ago, and in order to make the application of detail time study methods to a direct wage incentive plan economically possible, formulas and tables of standard data were developed from standard elemental time values obtained from a series of comparatively few selected representative detail time studies that had been made on standardized operations performed on members of a distinct class of parts or items.

A time study formula is merely an algebraic statement of operating facts, derived from recorded observations of actual similar standardized operations performed on a specified class of parts, arranged to permit the economical computation of relatively consistent time values for processing parts within the limits of that class, and according to a specified standard procedure.

In the course of time a uniform plan

of procedure, Fig. 1, was developed to guide our time study men in the construction of such formulas. The same care is exercised in the selection of the operators to be time-studied as the operating conditions and operations are as thoroughly analyzed when obtaining time study data for the construction of a formula as are employed when making any other kind of detail time and motion study, and the procedure previously described in this connection is strictly followed.

It is always advisable that the constructor of a formula should have made at least some of the detail time studies which are to be used in the formula, in order that he may be thoroughly familiar with the operating conditions, preclude the use of obsolete data in its construction, and be able to correctly determine the scope of its application and the most practical and explicit form in which to present the pertinent data.

Familiarity with the details of the operating conditions enables the formula constructor to make a just and adequate disposition of certain "special time allowances" for necessary periodically occurring irregular operations, which are encountered when certain members of the group of parts that are to be covered by the formula must be processed.

Time Study Formulas and Tables of Plant of Westinghouse Electric and Mfg. Co.

By G. A. BAESLACK

Manufacturing Engineer, Westinghouse Electric & Mfg. Co.

The essential characteristics which insure practicability and reliability in the formula are:

Simplicity—By avoiding long complicated algebraic expressions, without sacrificing clarity, time will be saved in its application.

Accuracy—This is attained by using only reliable information which conforms to actual operating conditions, and taking care to avoid errors in the algebraic derivations.

Consistency—May be realized by taking into account the slight variations in the elemental operations which operators must contend with when processing parts of the same general type, but varying in size and weight.

Clearness—Is attained by strictly adhering to the standard shop parlance, and avoiding all possibilities of ambiguity and misunderstanding.

Construction Procedure:

When sufficient time studies have been made and all the pertinent operating information has been collected, an identification number is assigned for the formula by the Time Study Supervisor and the constructor then proceeds to post the available data, in ink on a Master Table of Detail Time Studies, as illustrated in Fig. 2. This table is a summary of the usable data

of all the detail time studies taken on the selected line of work. In the first column are recorded the elemental operation symbols, by which each elemental operation will always be identified when it is not specifically described.

The letters of the alphabet are chosen as reference symbols, and whenever more than twenty-six elemental operations are involved, the letters are used again with numbers appended as suffixes thus: A-1, B-1, Z-1, A-2, B-2, Z-2, etc.

The second column is reserved for describing every elemental operation that has occurred in each time study; for convenience these operations should be listed in the order of their occurrence.

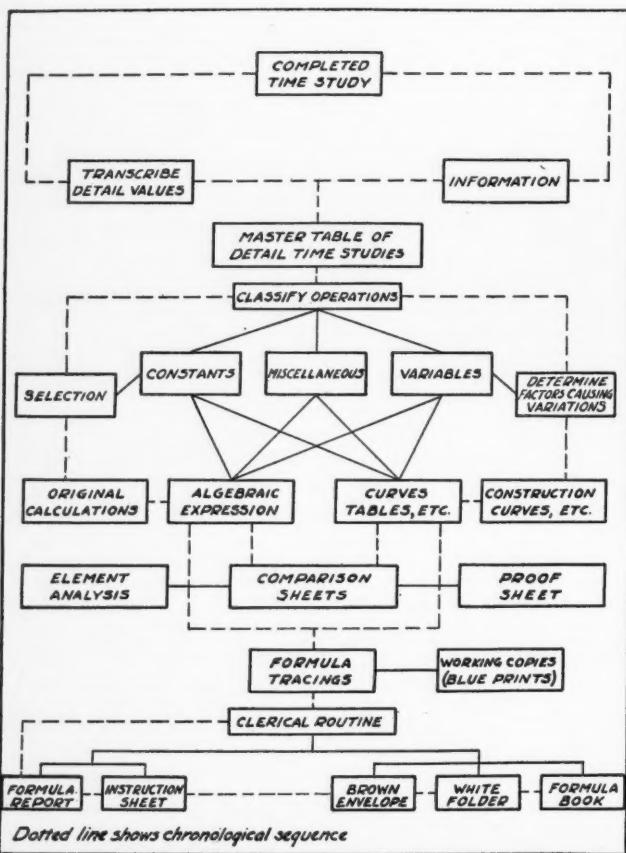
In the space designated "Job Characteristics", at the top of the sheet, are recorded the identification factors and physical characteristics of each job studied, such as the names of the respective operators, date and identification number of each corresponding time study as well as the weight, length, volume, diameter or cross-sectional dimension of the respective parts processed, where these affect the time values of any operation cycle.

A column is assigned to each time study, the one headed "S-1" being used for the first study, and so on,

and on the continuation of each horizontal "Operation Description" line are then recorded the corresponding elemental time values selected from each study in its assigned column space. The upper left hand corner is reserved for recording the formula identification symbol, the current date, the name of the parts processed, and other data as shown.

Classification of Constant, Variable and Miscellaneous Elements:

After the data from each time study has been recorded, a very careful an-



alytical study of each elemental operation and corresponding time values must be made and the reason for possible variations in the recorded time values for the same elemental operation determined, before the constructor can definitely decide which elements are to be regarded as constants and which as variables.

Variations between time values of identical elemental operations may either be due merely to differences in the skill and effort of the operators that were time studied, or to necessary physical differences in certain

types of the group of parts processed. It is quite apparent, therefore, that elemental operations can only be correctly classified by a constructor who is thoroughly familiar with the actual operating conditions and requirements of the job and that is the reason why the formula constructor himself should make a representative number of the time studies.

As an aid to future definite identification, each classified element is marked with a "C", "V" or "M" in the

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Fig. 1—Diagram illustrating Manner in which a Formula is Developed

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MASTER TABLE OF DET

FORMULA ME-1, #4
 DATE Nov. 6, 1937
 PART Shaft, from 60" to 1200" Rgh. Wt.
 OPERATION Rough Turn
 PERFORMED ON 30" Eng. Lathes

COMPILED BY John Doe

SYMBOL	OPERATION DESCRIPTION	TIME ALLOWED (IN HOURS)	REFERENCE						
			STUDY	S-1	S-2	S-3	S-4	S-5	S-6
A	Get drawing from drawing file	.0176	S-11	.0625	.0626			.0666	
B	Study drawing & make out list of dims.	Table 1	All Studies	.3064	.1390	.1805		.2206	.0875
C	Get hoist and move to material	.0069	All of S-10 Average	.0090	.0049			.0071	
D	Locate part	.0183	% of Average	.0015	.0123	.0514	.0430	.0112	
E	Attach rope sling to part	.0040	S-248	.0037	.0040	.0029	.0046	.0037	.0097
F	Hook on and lift	.0036	S-4	.0027	.0024	.0032	.0036	.0035	.0043
G	Move part to off from lathe	Curve 1	All Studies	.0073	.0075	.0061	.0088	.0056	.0060
H	Loosen tailstock-4 nuts	.0136	Average	.0118	.0143	.0189		.0110	.0110
J	Place part in machine	Curve 1	All Studies	.0102	.0089	.0051	.0147	.0053	.0065
K	Move tailstock in position	.0057	Average	.0049	.0046	.0034		.0043	.0079
L	Tighten tailstock-4 nuts	.0172	S-183	.0192	.0184	.0142		.0136	.0281
M	Run in and tighten center	.0040	S-187	.0049	.0033	.0033	.0047	.0035	.0041
N	Release knot and put rope aside	.0033	S-267	.0029	.0033	.0027	.0041	.0040	.0028
P	Print driving clamps (2 screws)	.0117	S-11	.0123	.0041	.0124	.0124	.0112	.0142
Q	Start machine	.0013	S-1166	.0013	.0013	.0013	.0014	.0013	
R	Pick up 6" rule and crayon	.0037	S-742	.0047	.0041	.0029	.0028	.0024	.0082
S	Mark off lengths (Per length)	.0043	S-12	.0043	.0043	.0036	.0043	.0033	.0060
U	Lay aside rule and crayon	.0022	S-12	.0022	.0019	.0017	.0022	.0020	.0020
V	Set tool to depth of cut	.0029	S-12	.0028	.0028	.0032	.0029	.0027	.0024
W	Run feed	.0011	S-26-78	.0012	.0011	.0012	.0012	.0010	.0011
X	Rough turn	Chart 1	All Studies	V					
Y	Run carriage back (per inch)	.00027		.00026	.00024	.00025	.00028	.0003	.0003
Z	Set back tool for undercut	.0141	S-11	.0158	.0128	.0134	.0143		
U-1	Undercut finishing fil	Table 2	S-1-345	.0633	.0384	.0853	.0434		
B-1	Run back tool clear	.0140	S-3	.0097					
B-2	Stop machine	.0013	S-116	.0013	.0013	.0013	.0013	.0013	
C-1	Locate driving clamps (2 screws)	.0103	S-6	.0100	.0074	.0124	.0111	.0096	.0105
D-1	Run center out	.0039	Average	.0042	.0028	.0029	.0042	.0033	.0028
E-1	Remove shaft from machine	Curve 1	All Studies	V					
F-1	Turn shaft end for end	.0038	"	.0038	.0038	.0038	.0123	.0043	.0059
G-1	Get stencils and hammer	.0038	"	.0043	.0036	.0077	.0043	.0043	.0061
H-1	Stamp order number on shaft	.0050	S-7	C	.0043	.0036	.0043	.0043	.0041
J-1	Lay aside stencils and hammer	.0152	Average	.0152	.0140	.0161	.0143	.0166	.0128
K-1	Lower shaft and unhook hoist	.0037	S-9	C	.0038	.0026	.0043	.0036	.0038
L-1	Arrange bar to lift	.0212	S-8	C	.0077	.0061	.0056	.0112	.0059
M-1	Change speed								
N-1	Place stencils on lathe in pos. & clamp	.0702	S-4	C					
P-1	Adjust " jaws & tighten 3 scrs.	.0046	"						
Q-1	Release " jaws	.0158	"	C					
R-1	Loosen " and push clear	.0268	"	C					
S-1	Loosen 4 nuts and remove tool from post	.0188	Average	C					
T-1	Procure tool from cupboard	.0150	"						
U-1	Place and tighten tool in post (2 scrs)	.0703	"	C					
V-1	Make tool set and set adjusting tool	.0345	S-11	C					
W-1	Get job, drawing and tool in time slot	.1000	Formula: Power Dept #2						
Z-1	Wait for crane service (over 1000 lbs)	.1660	"	"	"				
A-2	Crank lift job to machine	.0250	"	"	"	"			
B-2	Place part in machine	.0345	"	"	"	"			

Fig. 2—Master Table of Detail Time Studies

reserved space in the column adjacent to the one marked "Reference" in line with the respective element it identifies, as the classification progresses.

An elemental operation is classified as a "Constant" when an average ex-

perienced operator can always perform it in the standard major operation cycle covered by the formula by using practically the same cycle of primary motions, requiring approximately the same amounts of physical

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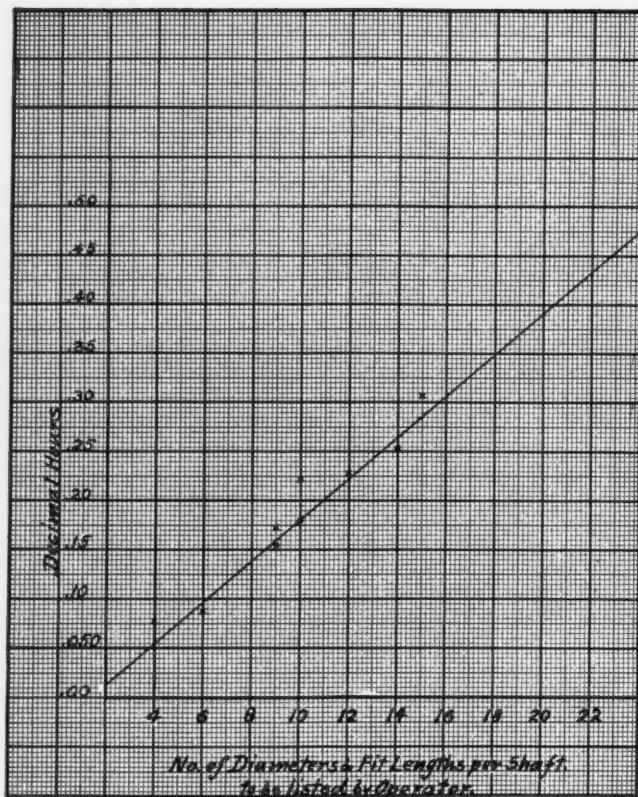
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Fig. 3—Chart showing Rate of Change in Time per Unit Change in the Number of Fit Lengths and Diameters Involved per Shaft



and mental effort, and time as measured by the stop watch.

Such elemental constants are: start the machine, stop the machine, lock the power feed, release the power feed, change speed, set cutting tool to cross feed dial and so on.

An element is classified as a "Variable" when the primary motions required to perform it vary with varying physical characteristics in some of the group parts which are to be processed in accordance with the major standard operation cycle covered by the formula; hence the amounts of physical effort and time required to perform such an elemental operation will usually vary with the size or

mental line of the "Master Table of Detail Time Studies".

Other variable elemental time functions can be most effectively incorporated in a formula by means of curves and graphic charts that show the relation between one or two independent variables and a dependent variable, and because of that fact they are frequently employed in time study formulas where they show the relation of the changes in the dependent elemental time variable corresponding changes in the value of the independent elemental operation variable.

The values of Tables 1 and 2 of the illustrative formula shown later in the text were thus derived from analysis.

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The machine illustrated in this advertisement is now available for distribution only in the United States of America.

curves. In the case of Table 1, which consists of time values covering the elemental operation "B" of the Master Table, the number of diameters and fit lengths per individual shaft to be rough turned are the independent variables that were plotted along the abscissa, and the corresponding time values of the Master Table are the de-

An element is classified as "Miscellaneous" when it denotes a certain necessary unavoidable elemental foreign operation which must be performed now and then in connection with the processing of individual items in a group of similar parts that are included within the limits of a formula. These miscellaneous elemental

values which represent operation made necessary by occasionally recurring abnormal conditions in one or several individual items a lot are conveniently disposed of in a formula by either expressing the time thus spent as a percentage of the total time allowed and then applying this percentage factor to the total of the standard formula unit time values, or when they only apply to a certain few types of the group of parts covered by the formula, it is ad-

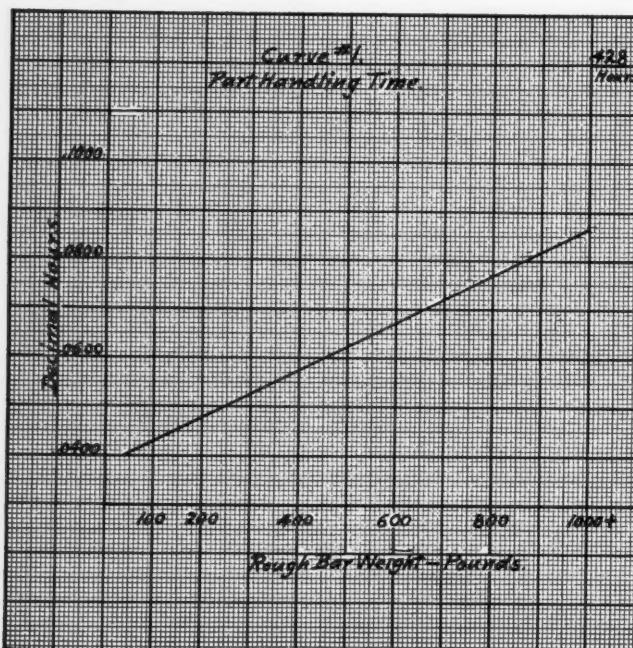


Fig. 4—Chart Showing Relation between Weights of Rough Bars and Handling Time

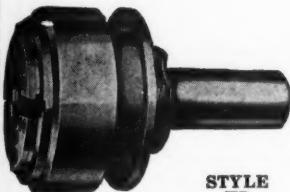
pendent variables that were plotted as ordinates. This is illustrated in the chart Fig. 3, which shows the rate of change in time per unit change in the number of fit lengths and diameters involved per shaft.

In like manner, Curve No. 1 of the formula, Fig. 4, shows the relation between the weight of the rough bars and the handling time of elements G, J, E-1, F-1 and K-1, of the Master Table of Detail Time Studies, Fig. 2.

visible to incorporate these values in a separate table of elemental miscellaneous values, accompanied by definite information with regard to their significance and application, and thus have them available for use whenever these types of parts are processed.

Upon completion of the classification of the elemental operations, the formula constructor selects the representative time value for each con-

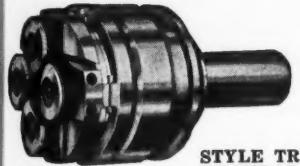
ROTARY DIE HEADS



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STYLE TR
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STYLE TR
CIRCULAR

Trim, compact, simply-designed tools like these stand up under the strains of high speed rotary threading. The fewest possible working parts are used, hardened and ground to precision limits. Chasers are held in rigid, solid support, yet adjustments are simple and accurate. The opening and closing action is smooth and sure—no chance for damaged work or tools.

Geometric offers two rotary die heads—the Style KD with regular chasers and the Style TR with tangent or circular Long-Life chasers. (Our Style TR heads require less "down time"; easier to set up and easier to adjust.) If you cut screw threads on live spindle machines, these die heads will earn profits for you by reducing costs, saving time and eliminating trouble. We have specialized in screw threading machinery and tools—since 1895.

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on these rotary die heads?

THE GEOMETRIC TOOL CO.

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stant element and records this value in the reserved space marked "Time Allowed" in line with the respective element it serves and then underscores each corresponding elemental time value which agrees with the selected value. In the corresponding space of the column adjacent to the one marked "Time Allowed" he records the respective time study reference information which pertains to the selected elemental time values.

Compilation of Table of Standard Data from Master Table of Detail Time Studies

To compile a "Table of Standard Elemental Data", the constructor tabulates the identification symbols, the description of the corresponding elemental operations, and selected allowed time values as well as the corresponding reference information in the order of their occurrence when the data is to be applied only to one specific processing cycle. In case the data consists of a great variety of elemental operations which cover practically all the routine manipulating elements of a specified type of machine tools such as 18-in. to 24-in. engine lathes, for instance, he will arrange it in convenient groups to make it more easily accessible for the user, as indicated in the Table of Standard Data for 18-in to 24-in. engine lathe, Table I.

Such tabulated information, accompanied by corresponding machining data consisting of the permissible standard cutting speeds and feeds dictated by efficient shop practice for the various kinds of materials and the respective machines may be applied for establishing time allowances for jobs within its scope. (The compilation of this data will be explained in the second half of this article.)

To use it for that purpose merely requires that a detailed record be made of the elemental manipulating

operations and of the machining operations involved in a specific job, thereby selecting the corresponding elemental handling time allowances from the standard data tables and applying each the number of times the respective element occurs, the total manipulating time will be the sum total of the resultant elemental time values.

In like manner the machining time is computed by multiplying the machine time values, selected from the machining data tables, by the length and number of cuts that must be taken or the depth in inches of holes of given diameter must be drilled or tapped, and so on. The sum total of the selected handling and computed machining time values will then be the established time for the particular job.

Establishing time values from standard data thus eliminates the necessity for making individual detail time studies in many cases. However, relatively just and consistent time allowances will only be established from standard data, if each job is first thoroughly analyzed and a careful motion study taken so that no necessary elemental operation is overlooked nor any wrong elemental values selected from the tables.

In case it is found that a job involves elemental operations not as yet included in the available standard data, then it becomes necessary to make an individual detail time study of that job and thus obtain the missing elemental values and incorporate them in the standard data table.

Construction of Algebraic Expressions from Standard Data

The purpose of constructing an algebraic expression from the standard data symbols is twofold; namely, to conserve time when applying the data to establishing time values for standardized jobs within the scope of the data, and to promote accuracy and consistency.

HOW DO YOU BUY STEEL?

Purchasing management formerly placed orders for steel on a price and shipment basis on the assumption of standard quality. However, with automatic processes and higher speeds, greater strains, etc., much closer uniformity is not only desirable, but often absolutely essential in securing faster factory schedules and lower production costs.

Anticipating this situation, Ryerson turned all old stocks, tightened specifications, and made inspections more rigid.

Only whole heats of alloy steel in narrow range analyses are selected for stock. Bars from every heat are analyzed and actually heat treated. Data sheets showing exact analysis and heat treatment results are sent with every order as a guide to securing the best heat treatment results. In addition, Ryerson certifies to the uniform high quality of every steel product.

Never before has any such quality control been attempted by a steel service organization. But the results are well worth the effort. Manufacturers are reporting savings in time, reduction in spoilage and lower costs. The safety factor is also an important consideration.

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land, Buffalo, Boston, Philadelphia,
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The first objective is attained by synthesizing, or combining, minor elemental constants to form a major

cycle of operations that embraces considerable portion of the total operation cycle which always occurs when

TABLE I
Table of Standard Data for 18" To 24" Engine Lathe

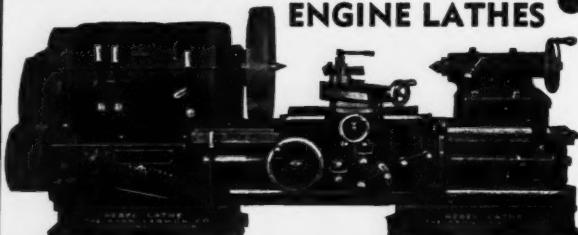
No. 1—Elemental Set-Up Operations

Symbol	Operation Description	Time Allowed in Hours	Reference
A	Get job and drawing.....	.0500	S-2
B	Get time card.....	.0400	S-1
C	Study drawing .....	.0250	S-1
D	Go to toolroom and get tools and fixture	.0910	S-3
E	Remove face plate from lathe spindle...	.0160	S-3
F	Remove chuck from lathe spindle.....	.0200	S-2
G	Clean threads and put face plate on lathe spindle .....	.0330	S-2
H	Clean threads and put chuck on lathe spindle .....	.0350	S-4
I	Remove head-stock center from spindle.	.0130	S-2
J	Remove tail-stock center from spindle..	.0090	S-1
K	Put head-stock center in spindle.....	.0065	S-2
L	Put tail-stock center in spindle.....	.0062	S-3
M	Change speed of lathe (throw back gears in or out and shift levers).....	.0052	S-1
N	Release four tail-stock nuts, push tail-stock into position and tighten four nuts .....	.0167	S-4

No. 2—Tool Handling Elements

X	Remove tool from tool-post, lay aside on tray .....	.0045	S-1
Y	Grind turning, boring, facing, parting, radius or chamfering tool.....	.0260	S-3
A-1	Grind threading tool to gage.....	.0730	S-2, S-4
B-1	Get and place a boring tool in tool-post, tighten and adjust to job.....	.0180	S-3, S-4
C-1	Get and place thread tool in tool-post, tighten and adjust to gage.....	.0400	S-2
D-1	Pick up and place parting or facing tool in tool-post, tighten and adjust to job	.0042	S-1, S-2
E-1	Pick up and place turning tool in tool-post and tighten.....	.0030	S-1, S-2 & S-3

GEARED HEAD & CONE DRIVEN
ENGINE LATHES



Sizes
16" to 36"
Swing

A full line of Gap Lathes
18" to 50" swing
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CINCINNATI, OHIO

TIME

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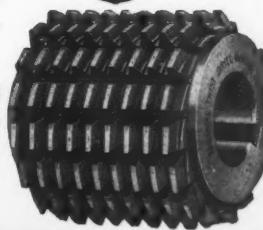
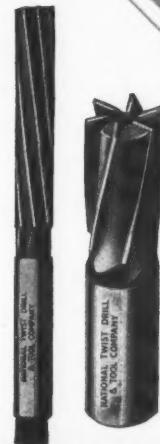
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Are *TIME SAVERS* Because:-

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¶ The inbuilt quality accounts for the excellent performance and long grinding life so uniformly reported by users.



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TABLE II

Table of Standard Data for 18" To 24" Engine Lathe
No. 3—Lathe Manipulating Elements

Symbol	Operation Description	Time Allowed in Hours	Reference
H-1	Start Lathe .....	.0006	S-1, 2 & 4
I-1	Advance carriage per inch, or fraction thereof .....	.0008	S-2, & 3
J-1	Advance cross slide with tool to work..	.0012	S-1, 3 & 4
K-1	Set turning tool to cross feed dial.....	.0024	S-2, & 4
L-1	Run back carriage per inch or fraction thereof .....	.0005	S-1, 3 & 4
M-1	Run back tool from work.....	.0006	S-2, 4
N-1	Lock carriage or cross slide feed clutch..	.0006	S-2, 3
O-1	Lock carriage to lathe bed with wrench ..	.0012	S-1, 3 & 4
P-1	Release carriage or cross slide feed clutch .....	.0004	S-2 & 4
Q-1	Release carriage locking bolt with wrench ..	.0010	S-1, 3 & 4
R-1	Reverse carriage or cross slide feed .....	.0006	S-1, 2 & 3
S-1	Throw in back gears.....	.0040	S-3, & 4
T-1	Throw out back gears.....	.0032	S-2, 4
U-1	Open steady rest.....	.0014	S-1 & 3
V-1	Close and tighten steady rest.....	.0025	S-1, 2 & 3
E-2	Stop Lathe .....	.0008	S-1, 2 & 4

No. 4—Part Manipulating Elements

J-2	Pick up 5-lb. to 19-lb. steel bar or arbor from skid and lay on carriage.....	.0006	S-2, 4
L-2	Place dog on shaft, or arbor, and tighten with wrench .....	.0014	S-1, & 3
M-2	Place combination of dog and shaft, or arbor, between centers and oil center..	.0018	S-3, & 4
U-2	Release and remove dog from shaft, or arbor .....	.0014	S-1, 2 & 3
V-2	Remove shaft, or arbor, from centers..	.0008	S-2, & 3
W-2	Lay 5-lb. to 19-lb. shaft, or arbor, aside on skid, etc.....	.0006	S-1, & 3

No. 5—Gaging and Measuring Elements

F-2	Gage 0. Diameter with micrometer (in one position) .....	.0026	S-2, & 4
G-2	Gage reamed bore with plug gage.....	.0042	S-5, & 6
H-2	Gage bore with pin gage (once).....	.0028	S-5, & 7
I-2	Measure with 6" or 12" scale, calipers, or snap gage, one length or one posi- tion only .....	.0016	S-1, 2 & 4

either all the parts or certain definite groups of similar parts, to be covered by a formula are to be processed in the described standard manner. One synthetic constant, its symbol and numerical equivalent, will then replace two or more minor elemental constants, symbols, and their numerical equivalents, all of which would otherwise have to be manipulated every

time a formula were to be applied.

The manner in which such synthetic constants are developed is clearly demonstrated in the "Synthesis" section of the illustrative formula which covers the operation of "Rough Turned Shafts", when performed in a specified type of 30-in. engine lathe.

(The concluding section of this article will be published in the September number of MODERN MACHINE SHOP).

"HOW DID WE EVER GET ALONG WITHOUT 'EM?!"



DUMORE NO. 2

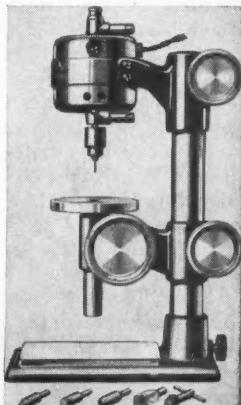
Flexible Shaft Tool

This handy tool develops from 2,400 to 3,700 r.p.m. when flexible shaft is attached at gear reduction end, or 6,000 to 12,000 r.p.m. when using the direct drive. Equipped with No. 0 Jacobs chuck (capacity $\frac{1}{8}$ " to No. 80 drill); 5 burs and 3 mounted wheels furnished.

DUMORE

Precision Drill

Here is almost unbelievable drilling accuracy, speed and simplicity. Vibrationless AC-DC motor has speed range of 2,000 to 8,000 r.p.m. through 6-step foot controlled rheostat. Equipped with a balanced No. 0 Jacobs chuck. Drills holes from $.0135"$ to $\frac{1}{8}"$ in diameter without danger of drill breakage. Rack and pinion feed has depth gauge. Table is $3\frac{1}{2}"$ in diameter. Drill center is $6"$ from column. Furnished with cone center, cup center, radius center and V-block. Height $14\frac{1}{4}"$.



"Hardly an hour goes by but what I find one, and often both, of those outifts in use," commented a tool room foreman, pointing to his Dumore Precision Drill and No. 2 Flexible Shaft Tool. "In fact, both tools are so indispensable to us now that I often wonder how we ever got along without them". This experience is typical of hundreds of shops which have these two versatile Dumore tools.

Wherever there is a high speed or precision grinding job to be done, a Dumore tool will save time and labor, assure greater accuracy and help produce a better finished product. Call on any Dumore Distributor for prompt, courteous advice or service without obligation . . . or write

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DUMORE

Precision GRINDERS and TOOLS

Suggestions on the Care and Handling of Abrasive Wheels

BY HENRY R. POWER
The Carborundum Company

MANY cases of wheel breakage can be traced directly or indirectly to careless handling or improper methods of storage. Wheels damaged in this way may, to all outward appearances, seem perfect although they may at the same time constitute a very real hazard.

Unpacking

All wheels are inspected by the manufacturer prior to packing and delivered to the carrier in perfect condition. They should be unpacked and inspected as soon as received by the customer to determine if the wheels have been damaged in transit.

Note first the condition of the container. If the container appears to have been subjected to rough handling and the contents damaged, have it held intact and your shipper notified.

If the container is in good condition, open it, exercising care that the tool used does not damage the contents. There is a right and wrong way of opening each of the several types of containers used in shipping abrasive wheels and a few suggestions on the subject are offered. **OPENING BARRELS:** The top hoops should first be removed before the head is knocked in. **WOODEN BOXES:** Remove all nails from the lid with a nail puller. Do not attempt to knock the lid off with a hammer. **FIBRE CASES:** A screw driver should be used to remove the metal staples after which the four sections of the top may be folded back. The sawdust or other packing mate-

rial may then be loosened and the wheels lifted out one at a time.

Inspection

Clean all sawdust from wheels with a brush. Check quantity, size, grit, grade and bond against packing slip and invoice.

Stand wheel or wheels on edge and strike gently with a light instrument such as the handle of a screw driver. If a clear ring is not produced, examine the wheel for cracks. If evidence of a crack is found, that wheel should be set aside. Where size permits, the wheel may be suspended by slipping one finger through the hole while making this test.

In any case, whether supported at the hole or on edge, the wheel should be struck at the same spot relative to the point of support to obtain comparable sound effects, revolving the wheel for the purpose. All wheels do not produce the same tone when rung nor does a low tone signify a cracked wheel. Certain wheels do not respond well to this test, notably those bonded with Resinoid, Rubber and Shellac. Oil or water-soaked wheels do not ring clearly. Wheels are often filled by the manufacturer with various resins and greases to modify cutting action. This also affects the tone or ring of the wheel.

Vitrified wheels sometimes contain what appear to be seams, either running around the periphery or across the side. These occur in the process of manufacture, and are neither frac-

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Engineers help you.



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Standard
Counterbores,
Countersinks and Spot-**

**facers will enable you to
produce high quality work at low
cost per piece--and that's the kind of
work you have to turn out as Industry
speeds up.**

On operations which -- due to character of material, fixture design, or necessary chip clearance -- require specially designed tools, let Gairing Engineers consult with your designers. We've been doing these things well **for 21 years** -- maybe we can help you.

Ask for Bulletin 803 on Standard and Special Cutting Tools and Tool Holders.

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tures nor incipient fractures. They do not affect the action of the wheel in any way. If such a wheel is rung and found to give a clear tone comparable to other wheels in the same shipment and of the same size, grit, grade and bond, it is sound and can be used. In case of doubt, the wheel should be marked and set aside. Notice should be sent to the manufacturer's representative or to the manufacturer. If soundness of the wheel is questionable, it should be returned to shipper.

Wheel Storage

The practice of stacking wheels or wheel stubs which are to be again placed in service on the floor or on benches in manufacturing departments is to be condemned. This is because of the danger of the wheels becoming oil-soaked, falling off the benches or being struck by moving trucks or other objects.

All stocks of abrasive wheels should be stored in racks in a central stock room under the supervision of a man who has been carefully instructed in the care of handling of wheels. In the larger plants where quantities of abrasive wheels are consumed, it is advantageous to select for this important position a man who possesses a broad knowledge of the use and application of grinding wheels. Such a man should be useful in keeping down to a minimum the sizes, grits and grades of wheels carried in stock, also in using up obsolete wheels.

Where it is necessary to change wheels on a machine frequently to accommodate different classes of work, a rack may be provided at the machine for holding the extra wheels, rather than to keep them in the stock room. In this case when one wheel is removed from the machine and another substituted, the extra wheel should be placed in the rack at once.

In the case of snagging wheels where it is customary to use a wheel

down to a given diameter and then transfer it to a second machine speeded to receive it, wheel racks should be provided for holding the stubs. Such a rack may be located in the department convenient to the machines.

We have pointed out the absolute necessity of suitable racks for the storage of abrasive wheels. On this point the wheel manufacturer, because of his wide experience, is well equipped to give advice and would appreciate being consulted in the matter.

In general, all wheels 6 in. in diameter and larger should be placed on edge in such a way that they cannot tip over or roll. Wheels less than 6 in. in diameter, also Type 11 Flaring Cups and Type 12 Dish wheels, are best stacked flat. Type 6 Straight Cup wheels may be stored either flat or on edge. Small wheels 2 in. in diameter and less are best stored in bins or drawers, as their size makes it next to impossible to carry them stacked in racks.

All Resinoid, Rubber and Shellac bonded wheels $\frac{1}{4}$ in. and less in thickness, regardless of diameter, should be stored flat, one on top of the other, on a perfectly flat surface, to prevent warpage. See Section III—Rule 3.1 of the American Engineering Standards Safety Code 1930 Edition.

Mounting Wheels

Before mounting, every vitrified bonded wheel should again be closely inspected and rung to make sure that it has not been fractured while in stock, or through subsequent handling. See that the wheel slips onto the spindle without binding. In general, the hole size should be about 0.005 in. larger than the spindle diameter. In case the wheel shows a tendency to bind, the bushing should be very carefully scraped or reamed to give an easy sliding fit. Any evidence of a loose or shifted bushing should be

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carefully looked for, particularly on a rebushed or remounted wheel. Also, see that the bushing does not extend beyond the side of the wheel.

See that the blotters on the sides of the wheel are slightly larger than the flanges, are perfectly smooth, and centered with the hole. For further information on this subject see Section IX—Rule 9.5 of the Safety Code.

When wheels are to be used with Perks Safety Washers, blotters must not be used as they will nullify the safety feature of the washers. Orders for such wheels must state clearly that no blotters are to be attached to the wheels. If the wheel in question is one of the safety shape types, be sure that the degree of taper corresponds with that of the flanges with which the wheel is to be used. See Section VIII of the Safety Code.

It is presumed that the operating speed of the machine on which the wheel is to be mounted is known. If this is not the case, the speed should be checked to make sure that it does not exceed the maximum operating speed shown on the Preserve Tag accompanying the wheel. Also see Section X of Safety Code.

Section IX—Rule 9.6 of the Safety Code has the following to say on tightening of nuts: "When tightening spindle end nuts, care should be taken to tighten same only enough to hold the wheel firmly; otherwise the clamping strain is liable to damage the wheel or associated parts." The same applies to screws or bolts for holding wheels in sleeve flanges. A wrench or screw driver with a handle of normal length or size should be used for this purpose.

Flange pressure means compression in the wheel, with its natural consequences. Correctly mounted, the wheel should be held tightly enough between flanges to prevent wheel slippage and to transfer the driving torque, but not tight enough to approach the ultimate

strength of the material composing the wheel.

Machine Condition and Operating Suggestions

All grinding machines should be kept in good mechanical condition and free from vibration while in operation. Loose or worn bearings should be replaced or repaired at once. Lubrication should be inspected at regular intervals, the period depending on the type of bearing and nature of the service. A bearing which heats up unduly in operation may cause breakage due to the expansion of the spindle.

We quote Section VIII—Rule 8.1 of the Safety Code on the subject of flanges: "All abrasive wheels shall be mounted between flanges, excepting those which are mounted in chucks cemented to metal backs, or otherwise securely and adequately mounted on spindles." Such flanges should be of approved design and maintained in perfect condition at all times.

This section gives full details on flange design and construction, and is one of the most important covered by the Safety Code. We might add that flanges should bear evenly and, to compensate for the slight inequalities in the surface or sides of wheels, blotters are provided. The area of bearing of each flange should be equal and opposite; if this is not the case, a shearing force is set up in the wheel.

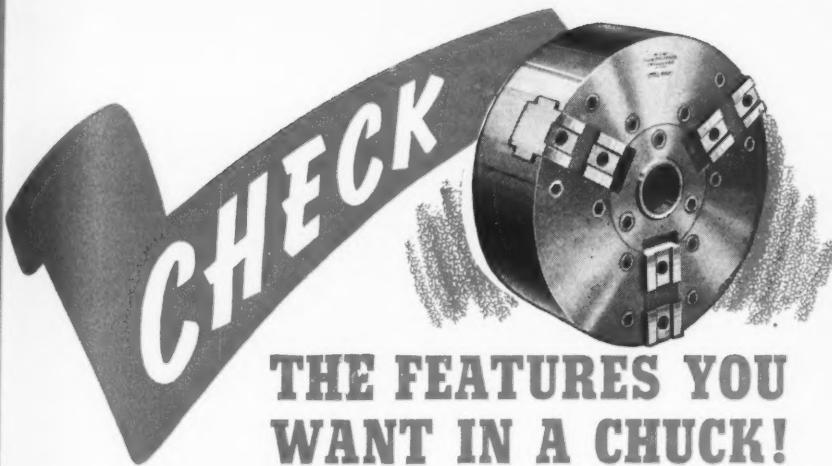
Safety Code Section V—Rule 5.1 states: "Hoods shall always be used with wheels which are not provided with protection flanges, bands or chucks." This section gives full details on design and construction of protection hoods and the wheel user should make himself thoroughly familiar with it.

When first starting up a new wheel or one that has been remounted, it is advisable to stand to one side and allow the wheel to run at full oper-

One-p
Heavy
groove
tains a
definit
draw w
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Ret
for
Hamme
ton, w
packin
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parts.
shape
sump
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THE FEATURES YOU WANT IN A CHUCK!

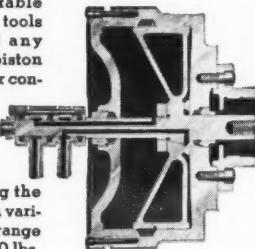
Model B Heavy Duty 3-Jaw Chuck

One-piece electric steel body. Heavy duty single groove jaw slot. Retains accurate fit indefinitely. Dustproof draw sleeve, oversize one-piece forged operating levers.



Rotating Air Cylinder for Chuck Operation

Hannifin "Leak-proof" construction, with graphite treated piston packing adjustable without special tools or removal of any parts. Special piston shape reduces air consumption to the minimum. Air connection packings adjustable without stopping the machine. Built in various sizes, power range 390 lbs. to 20,000 lbs.



- Naturally you want fast smooth action, accuracy, minimum air consumption. Then simple and substantial construction plus easy adjustment to assure long life with minimum attention.

Investigate Hannifin Air Operated Chuck design with these features in mind. Bodies are one-piece cast steel. The jaw slots have heavy-duty single grooves to retain accurate fit indefinitely. One-piece forged operating levers are oversize for positive and dependable operation. Draw sleeves are dust proof, protecting the working parts. Hannifin rotating air cylinders for chuck operation have the exclusive "Leakproof" construction with easily adjustable piston packing, special piston shape, and simplest air connection adjustments.

Many leading manufacturers have standardized on Hannifin equipment for production chucking operations. All machine tool builders can furnish Hannifin equipment on new machines.

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AIR OPERATED CHUCKS

ating speed for at least a minute. After the above assurance of safety the wheel should be trued with an approved dressing tool. This will eliminate any eccentricity due to mounting. The truing is worse than useless unless it is done against a fixed tool post, or with the dresser fixed in position so that the tool does not simply follow the contour of the wheel.

Where the grinding operation is to be performed wet, care should be taken to see that an adequate supply of clean solution is delivered at the point of contact between wheel and work. Grinding machine tanks or central solution tanks should be cleaned at sufficiently frequent intervals to prevent excessive accumulations of abrasive and metal chips. Foreign particles such as these in the grinding solution may be the cause for unsatisfactory finish. If allowed to accumulate, these chips may reduce the capacity of tank to such an extent that the effective cooling power of the solution is reduced. The effect will be inability to hold the size of the work within close limits.

Economical Die Casting at Mt. Vernon

(Continued from page 44)

sides of the vee-grooves, a rear set rounds the edges of the pulleys, and a reamer on the turret—piloted in the headstock to assure a true cut—cleans out the hole. Pulleys thus turned are readily held within 0.005 in. for concentricity.

Numerous other specific cleaning and machining operations might be detailed if space permitted, but enough have been mentioned to indicate that a well-ordered production in which a high degree of economy is attained, is achieved. The equipment and methods used have placed the plant in a good competitive position, and the diversity of industries it serves has

helped to keep it in operation when some others have been relatively slack during recent months.

"When You Can Measure", a 32-page brochure published by the General Electric Co., Schenectady, N. Y., tells briefly the contributions of General Electric engineers and scientists to the important art of measurement. This attractive, beautifully printed publication describes in pictures and words the story of how instruments are designed, constructed and tested in G-E headquarters. Every development in electricity has grown out of experiments in which instruments played a major part. The incandescent lamp, the electric motor, electric household appliances, radios—none of these commonplaces of modern living would have been possible without the imposing array of ingenious, sensitive, accurate measuring devices which engineers have perfected.

Since measurement, in its final form, depends upon comparison with some carefully chosen standard, a section of the booklet is given over to a description of the G-E standards of voltage, resistance, time, and temperature.

Copy free to any mechanical executive upon request.

Tantalum Carbide Tools and Blanks A 12-page catalog and price list of Vascoloy-Ramet standard tantalum carbide tools and blanks is now being distributed by Vascoloy-Ramet Corporation, North Chicago, Ill. The booklet describes the ten grades of Vascoloy-Ramet which cover all usual applications and mentions seven additional grades recommended for special applications. Three standard styles of blanks are listed and several special shapes are illustrated. Dimensions, specifications and prices are given for 18 styles of standard tools which are obtainable in finished or "milled and brazed" form.

Copy free upon request.

Timken Quality Tubing. This 24-page illustrated booklet explains in detail the numerous and varied industrial applications of the latest addition to the Ryerson stocks of Certified; that is, Timken Quality Tubing. Included are physical property specifications, tolerance charts, numerical equivalent tables and other data of importance to the user and buyer of seamless mechanical tubing. Copy free by addressing Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago, Illinois.



Building Blocks FOR INDUSTRY

Some of the world's largest industries have built their success upon the precision of Johansson Gage Blocks. Accurate to $\pm .000008$ inch, they are unexcelled by any other commercially available standards of measurement—yet priced within reach of the small shop worker. They are sold

in sets or individually, separate blocks priced as low as \$3.50. Foremen and shop owners should investigate also the low-priced accessory sets and the assortment of Adjustable Holders, which protect blocks and make handling easier. Catalog No. 12 contains full details. Write to Dept. G.



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For Your Tool Grinding...



The Norton "B-E" Bond Wheel

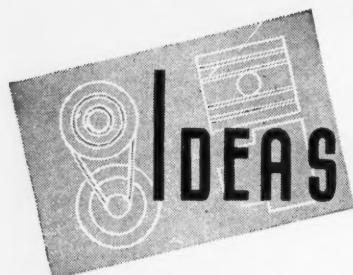
HERE is a wheel that is setting a new record for tool room wheel performance. Users of Norton "B-E" bond wheels report that they are able to get extra production and longer wheel life without sacrifice of cutting speed and without the danger of burning the most heat-sensitive tool steels.

Try this "B-E" bond wheel on your fussiest tool grinding job and see for yourself. It is available in all tool room shapes and sizes and in any desired grain and grade.

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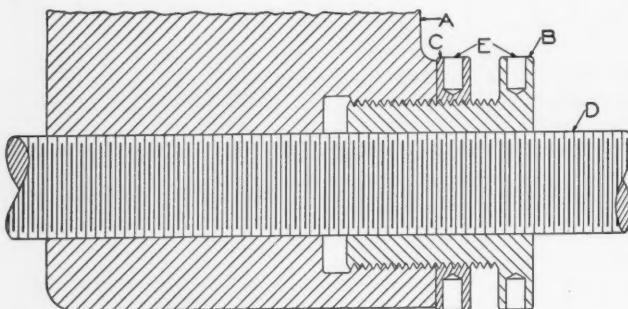


IDEAS FROM READERS

Eliminating Backlash from a Precision Screw

By J. R. WHITTES

THE mechanism shown in the drawing provides a simple, but effective, method of eliminating the backlash from a precision screw.



Cross-Section Drawing illustrating Method Used to Eliminate Backlash from a Precision Screw

The screw D, has a 29-deg. Acme square thread, for which a corresponding thread is provided in the bearing A through which it extends. The front end of the bearing is also bored and tapped for a 12-P. U. S. Std. thread on the adjusting nut B, which in turn is bored and threaded to fit the screw D. By revolving the adjusting nut B, as much pressure as desired can be brought to bear against the sides of the square threads on the

precision screw and any existing backlash can thus be eliminated.

After the adjusting nut has been adjusted as required, it is locked in position by tightening the locknut C against the face of the bearing. The holes E are provided so that pins can be inserted and used to turn pins B and C.

Paint Scrapers for Threads

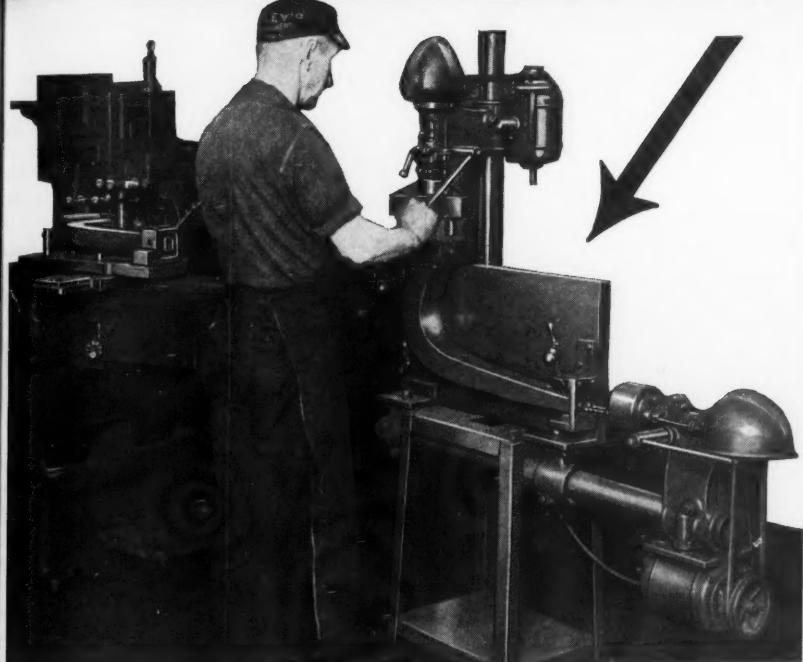
By C. COLE

SCREWS and bolts that are used to hold lighting shaft hangers, partitions to ceilings, and so on, are usually painted at regular intervals. Consequently, in time it becomes impossible to screw a nut onto a screw if these bolts are painted.

from or onto one of these bolts until the paint has been removed.

Blow torches have been used to burn the paint off, and hammers have been used to loosen the nuts, but the result has been the ruination of the threads and the time involved in loosening the nut has been out of proportion to the importance of the task. The paint can easily be removed, however, with the aid of the tool shown in the drawing.

THIS OPERATION COSTS NOTHING!



HOW TO PUT IDLE TIME TO WORK

This photograph shows the milling and drilling of an overarm for a scroll saw. The operator loads the arm in the milling machine, starts the first cut, then loads a previously milled arm into the special drilling fixture set beside the milling machine and drills four holes in the arm. By the time this operation is completed the first cut is finished on the milling machine. The arm on the milling machine is then indexed for the second cut, and, while this cut is being made, the operator transfers the

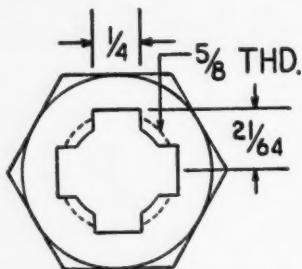
drilled arm to another Delta drill and taps two holes. The drilling and tapping operations are done during the time that the operator would otherwise be idle—so these operations cost nothing for labor!

The portability and adaptability of Delta drill presses, which enable them to be set up alongside another machine to utilize idle time, are only two of the many advantages offered by this low-cost, high-efficiency equipment.

Let us tell you more about how Delta Drills will save money in YOUR plant.

DELTA MFG. CO. 644 E. Vienna Avenue, Milwaukee, Wisconsin

The tool is nothing more nor less than an ordinary hexagon nut in which four slots have been filed, as shown. The slots will vary of course, with the different sizes of nuts. To use, the slotted nut is screwed onto



Paint Scraper Made by Slotting a Nut

the thread that is caked with paint. As the nut is revolved, the paint is cut from the thread of the screw and expelled through the slots in the nut. If the nut has been case hardened, it will last for a long time.

Although simple and inexpensive, the nut is a very useful tool.

Bulldozing Restores Valve Stems

BY CHARLES C. LYNDE

COINCIDENTAL failure of the cooling water system and the human element caused the shut-down of a main line pumping station on a South American crude oil pipeline, examination indicating that almost all valve stems and guides were damaged past further service.

Since the entire stock of replacement parts numbered only enough valves and guides to re-equip one of the four gas engines, other reconditioning was necessary. The pipeline shop included a welding torch, but no one

on the operating staff was ~~ad~~ enough to build up a thin layer of metal over the scored stems to withstand turning and grinding in the lathe without leaving bad spots of hard metal or torn areas which would not form a proper oil seal.

Original design called for a ~~hole~~ hole, reamed, in the guide, with the stem, of the same nominal diameter ground off sufficiently to provide necessary clearance. When all the stuck valves had been removed it was evident that reaming of the guides was imperative, and refinishing of the stems throughout the working guide-contacting section likewise demanded.

To provide the metal to fill the newly reamed guides, as well as that required for the stems themselves, was decided to try and upset the stems over the 13.5 in. of guide contact, although the shop had no tool suitable for this work.

A spherical recess was first made in a log large enough to take the end of the valve, this log being braced rigidly against a pump foundation. The other end of the valve stem was put under pressure with a hydraulic jack, likewise firmly held against stem motion. Under the worn section of the stem was fixed a heating muffle made from a corner of a hollow building tile. Supporting the stem through

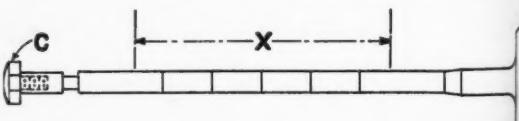


Fig. 1—Drawing of valve stem, showing (X) section upset regrinding and (C) case-hardened capscrew used to take space left by upsetting.

this muffle were spacers, made of 2-in. bits of $\frac{1}{4}$ -in. welding rod, arranged along the vee in pairs to permit the flame from the welding torch to strike the top of the stem and circ

*fail*ing Performance

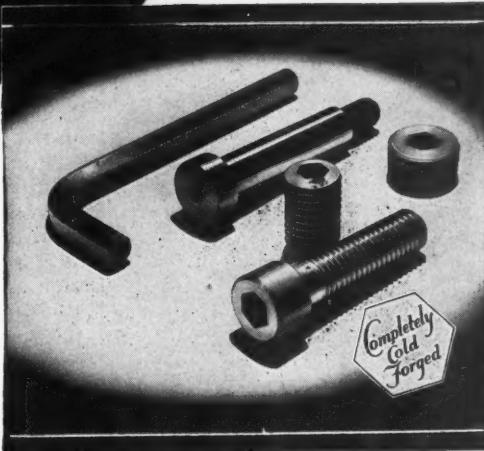
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Style, size, thread, etc.
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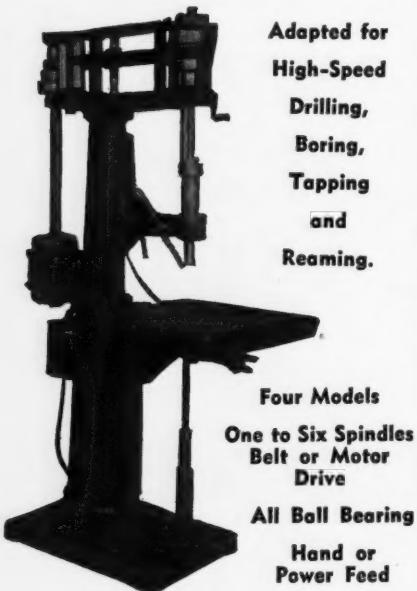
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DRILLS

For Low Cost Production

Those who measure the value of a tool by the cost of the work it does, will find the PROVIDENCE PRECISION DRILL the most economical they can use. EQUIPPED WITH HIGH-GRADE BALL BEARINGS AT EVERY ROTATING POINT, more power is actually applied for production, and less for wearing out the drill. This—and other distinctive features—explain why the PROVIDENCE drills more holes at less cost per hole.



PROVIDENCE ENGINEERING WORKS, INC.

523 So. Main St., Providence, R. I.

it under the guidance of the sides of the vitrified tile vee.

By first applying pressure to the rod with the jack, and then carefully heating a short section of the stem, it slowly heated it would yield to pressure and the cross section would expand. Regulation of the extent and degree of the heat as the torch slowly moved along the stem, in

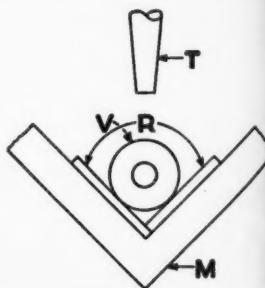


Fig. 2—Drawing illustrating method used to heat valve stem. V—valve stem. T—torch. M—muffle of tile. R—welding rod used.

connection with closely maintained hydraulic jack pressure against the sides of the stem, gave a uniformly upset section which checked closely to the 29/32 in. desired. So close was the work after the men gained a little experience that the shortening of overall length due to upsetting was less than 1 in. with $\frac{1}{8}$ in. as the theoretical amount to be expected, disregarding the amount ground away for clearance.

After the upset rods had been given a light roughing cut in the lathe they were ground individually to fit the newly reamed guides, using a two-post grinder in the lathe. To provide the desired length to the new shortened stems a capscrew, case-hardened on the top to withstand rocker arm wear, was screwed into the tapped hole in the end of the valve stem provided by the engine builder after removing springs.

When You're Cramped for Space

USE THESE VERY LIGHT INCH SERIES BEARINGS

HAVING bores abnormally large, as compared with the outside diameter, they offer the engineer such important advantages as compactness, light weight and greater latitude in design.

They are available in the "S" and "XLS" ball bearing series, the former starting at $\frac{1}{8}$ -in. bore and the latter at $1\frac{1}{8}$ -in. bore, the complete range running up to 21-in. bore and 28-in. O. D.; and there is the "RXLS" series extra light roller bearings, paralleling the "XLS" in size range.

Why not let our engineers tell you more about these Very Light Precision Bearings? Write for the Catalog.

"XLS" SERIES

"RXLS" SERIES

"NORMA-HOFFMANN"

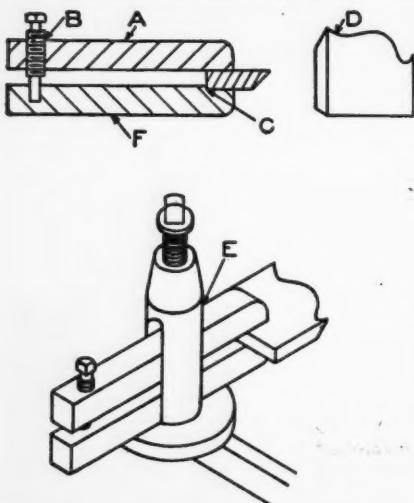
PRECISION BALL, ROLLER AND THRUST BEARINGS

NORMA-HOFFMANN BEARINGS CORP'N.—STAMFORD, CONN., U. S. A.

Forming Tool Holder of Simple Design

By A. H. WAYCHOFF

THESE are many cases where work can be expedited by the use of a form tool for finishing, the form tool being of the type shown at D in the illustration. However, it is



Drawing Illustrating Design of Simple Tool Holder for Forming Tools

sometimes a difficult matter to find an economical and efficient method of holding the tool. The drawing illustrates the design of a holder that will

satisfactorily hold a wide variety of blades and cutters.

The holder consists of the two pieces of steel A and F, each of which is approximately the width of the tool holder. The forming tools are made to a thickness of about half the thickness of the upper and lower pieces. The lower section is shouldered at the point C so as to prevent the blade from working back under the pressure of the cut.

The rear end of the upper piece is drilled and tapped for the compensating screw B, and a blind hole is drilled in the bottom piece F to receive the end of the screw. The screw is to provide for any variation in the thickness of the cutter blade.

To use, the forming or finishing tool is placed between the upper and lower pieces with the rear of the blade against the shoulder of the recess. The compensating screw B is adjusted to bring the upper and lower pieces parallel, and the holder, with the blade, is then slipped into position on the toolpost. With the toolpost screw tightened down, the blade will be held rigidly.

Metaline Oilless Bronze Bearings are the subject of a four-page folder being distributed by R. W. Rhoads Metaline Co., Inc., Long Island City, N. Y. Illustrations show one-piece, two-piece, plain and flange-type bearings, as well as several special types. Copy is upon request.

Cut Mallet Cost 50% with Toughite SAF-TY Mallet



5 HEAD SIZES

A size and weight for every job.

1" dia. x 2 1/2"	2 weights
1 1/4" dia. x 3"	2 weights
2" dia. x 3 1/4"	4 weights
2 1/4" dia. x 4 1/4"	4 weights
2 3/4" dia. x 5 1/2"	4 weights

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Flareproof—Won't Sponge—Stays Solid—Perfect Balance
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HELPING GOOD MECHANICS DO BETTER WORK

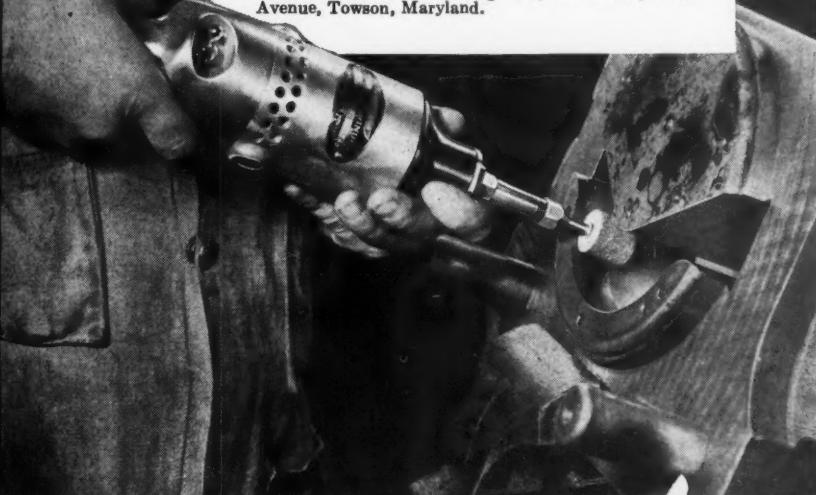
You'll "Whistle while you Work" with these new Die Grinders!

HEFT a Black & Decker Die Grinder—try its perfect balance—feel how it fits the hand. Then watch that smooth power do its precision work.

Our No. 12 (illustrated above) and No. 7 Die Grinders, plus the two High Speed Portable Grinders and four Heavy Duty Grinders, give any die shop, stamping plant, tool room or metal working plant a group of precision-built tools ideally suited for the job.

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Over the Editor's Desk

"---And how did you find business?"

THIS one question is fired at your editor more often than any other, due to the fact that some eight or ten times a year he leaves his desk and goes to have a "look-see" at what is going on in the several and various corners of industrial America. On the latest journey he spent two weeks in New England, where he found business steady, although slow, with a very definite feeling of optimism concerning the possibilities for Autumn. And all we need is enough optimism.

It might be of interest to our readers to know that remote control is not depended upon by the publisher and editor of this magazine in order to maintain contact with the important sections of the industrial field and with those firms who make use of the pages of this magazine to present the stories of the machines and tools which they are prepared to supply. The editor and his assistants travel many thousands of miles each year for the purpose of establishing first-hand contact with manufacturing plants in various industrial sections. In July the editor was in New England; the month before he journeyed through Southern Michigan; in May it was Missouri; in March it was Louisiana, Texas, and Old Mexico; in January it was the industrial section of New York State—and he is only one member of the organization.

Not all metal-working plants are sufficiently unusual to be of interest to the progressive plant executive;

in fact the percentage of such plants is small. The average turning, boring, facing, or drilling operation is common to be of interest to the works manager who is a step ahead of the procession in his methods and tools. Still, there are many interesting developments taking place in American industry, and American manufacturers as a whole are a cooperative lot.

During the four remaining months of this year this magazine will carry to its readers the story of a locomotive repair shop in Mexico City, the story of a plant in the East where the work is so large that the machine tools have to be carried to the work, the story of the ultra-modern automatic conveyor system in use in a large electric refrigerator factory, the story of the tools and fixtures in use on the production line in a large electric motor plant, a story of up-to-the-minute production methods as applied to the building of machine tools, and so on.

Added to these will be articles on modern die design, an outline of safety methods in use in a great and well-known manufacturing plant, articles on planning and production methods, an up-to-date apprenticeship training course, practical heat treating methods in use in several New England plants, material-handling methods in an English cycle factory, die design and construction, the use of metal inserts in plastic molding, and the usual assortment of short articles describing single tools and devices of particularly interesting design. We hope you like 'em.

SUPER



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TS A

Jacobs

IT HOLDS!

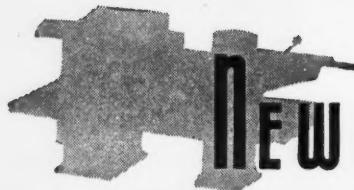


THE LAST WORD IN MODERN
ENGINEERING DESIGN



JACOBS BALL BEARING
SUPER CHUCKS

THE JACOBS MANUFACTURING COMPANY
HARTFORD CONNECTICUT, U. S. A.



NEW SHOP EQUIPMENT

Lanhydro Double End Threading Machine

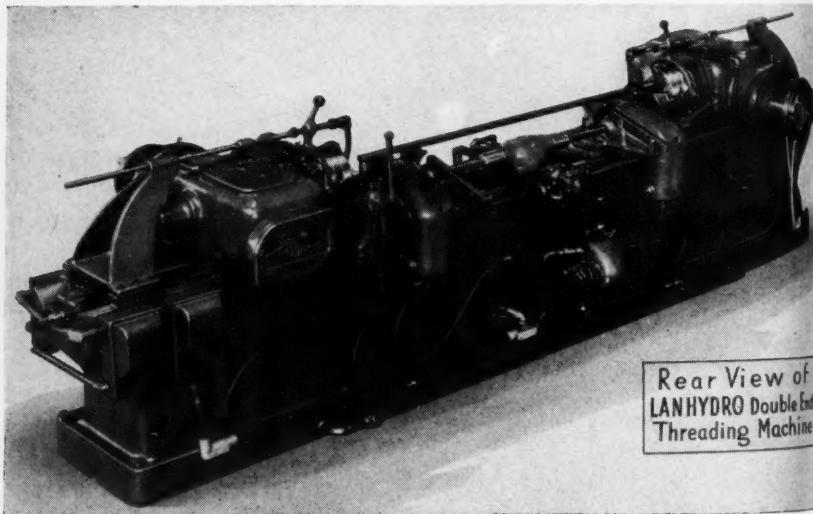
The Landis Machine Company Waynesboro, Pa., has added a new unit to their extensive line of equipment. The unit, known as the Lanhydro Double End Threading Machine, will cut threads simultaneously on both ends of tie rods, short bars, and so on. This machine opens an entirely new field for the handling of work of this type on a production basis.

The design of the Lanhydro Double End Threading Machine has been carefully engineered to insure maximum life to the operating parts and the utmost in efficiency of operation. The operating cycle is simple and the machine is very easy to operate.

When in operation the Lanhydro Double End Threading Machine passes through the following cycle: The operator places the work to be threaded on the work supports positioning it in the

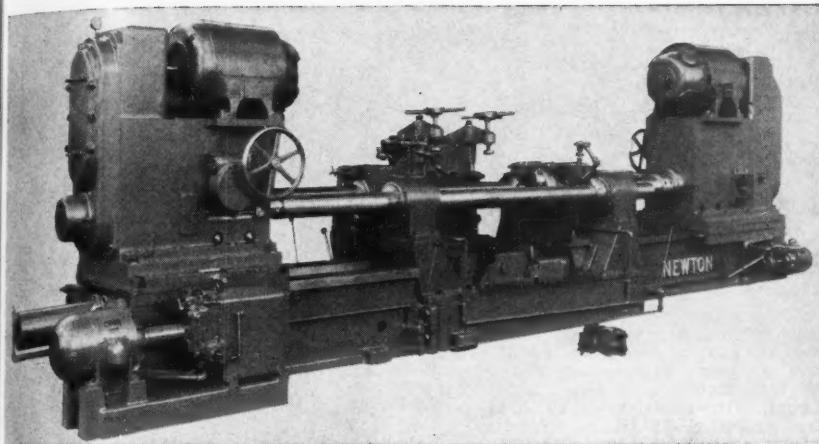
open gripper jaws by bringing the end of the work in contact with the work stop. He then actuates the main control valves by a hand lever, thus closing the gripper jaws. The work stop then raises to clear the threading unit, and both threading units advance rapidly to a predetermined point at which the chasers are just clear of the ends of the work. At this point the threading units drop into a threading feed which continues for the duration of the threading operation. The opening of the threading heads is controlled by yokes and trip rods on each threading unit. Upon completion of the thread, the opening action of the die head shifts a valve which causes the threading units to return at high speed to their original or "rest" position.

The return movement of the threading units closes the die heads automatically and operates the valve which opens the gripper jaws. The work ejector cylinder is actuated by the opening of the gripper



Rear View of
LANHYDRO Double End
Threading Machine

Lanhydro Double End Threading Machine



Newton Heavy Duty Two-Spindle Boring Machine

jaws and following this movement the work stop is lowered.

Several movements of the hydraulic system are controllable through separate valves to permit increasing or decreasing the functioning speed of the movement. These adjustments are provided in order to insure the minimum idle time for the various diameters which the machine will handle.

An important feature of the hydraulic system of the machine is the provision which is made for controlling the thread lead. Through a special pressure control valve, the threading units can be advanced under pressure at a definite feeding speed for the full length of the thread.

The cutting speed of each threading unit is independently controlled by pick-off type gear boxes. The machine covers a wide diametrical range of sizes from $\frac{1}{2}$ to 2 in. inclusive. The minimum and maximum length of the bars which can be handled on the machine shown in the illustration are 4 ft. 2 in. to 8 ft. $\frac{1}{2}$ in., but the maximum length which the machine will handle can easily be increased to 10 ft. if so desired. The maximum travel of the threading head units is 22 in. and a corresponding thread length is obtainable when maximum length bars are being handled.

Newton Heavy Duty Two-Spindle Boring Machine

Large cast steel electric railway motor frames are bored and faced on the Newton Heavy Duty Two-Spindle Boring

Machine illustrated herewith—product of Consolidated Machine Tool Corp., Rochester, N. Y. The machine employs the new Newton Unit Head Construction, which consists fundamentally of two unit heads mounted on saddles which slide on wings. These wings, in turn, are fastened to opposite ends of a stationary floor-type work table.

Each spindle head has its own motor direct-connected through suitable gears. Anti-friction bearings are used throughout. In addition to feed to each head, spindles are mounted in sleeves independently adjustable for "in" and "out" position. Work which contains large and small bore is mounted on fixtures on the work table. Boring bars are driven by the individual unit spindle heads. They are piloted through bushings in the fixture.

A larger boring bar holds the cutter head on which are mounted sets of tools for taking rough and semi-finish cuts on the different diameter bores, for chamfering and for facing one end of the work. This bar also has provision for holding tools for facing and boring the other end of the casting. A smaller boring bar has provision for three boring tools and also holds a facing tool for performing the various operations on the smaller bore.

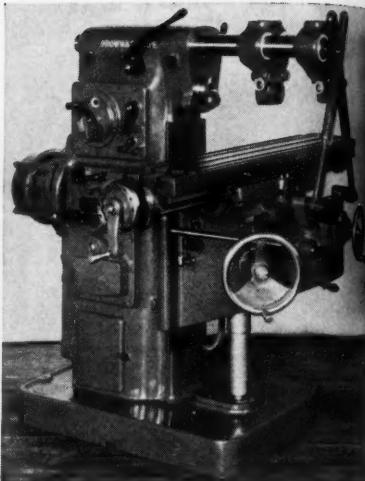
Hydraulic feed and rapid traverse in both directions are provided for both boring bars and are easily controlled by conveniently located levers. Provision is made for easy accurate adjustment and removal of all tools. Cutting lubricant is brought to the cutting tools by

means of a pump. Lubrication to the spindle heads is by individual built-in pump.

B & S "Light Type" Milling Machines

Addition of two "Light Type" Milling Machines to their line is announced by Brown & Sharpe Mfg. Co., Providence, R. I., to be known as the No. 2 Universal Milling Machine (Light Type with Power Fast Travel) and the No. 2 Plain Milling Machine (Light Type with Power Fast Travel).

These machines are said to have all the proven advantages of moderate weight, ease of handling, ample rigidity and modern construction characteristic of the Brown & Sharpe "Light Type" design. In addition, they have power fast travel of 76 in. per minute in all directions provided by a totally-enclosed, constant-speed motor built into the right side of the knee, and obtained, in any direction of feed engaged, merely by touching a switch button at the front of the knee. When the button is released, the table resumes its original feed movement. Since power fast travel is independent of both spindle and table feed drives, it is available at all times. The construction and location of



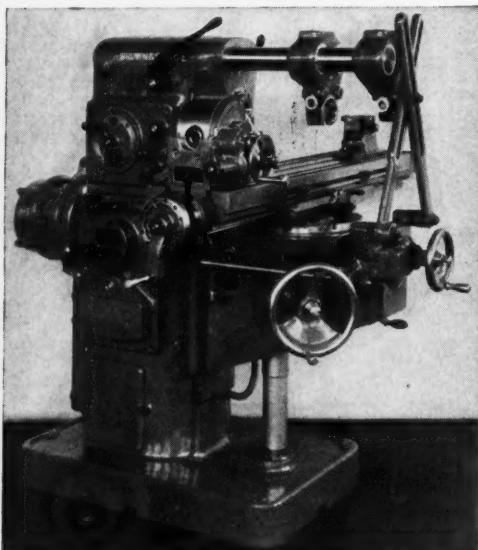
B & S No. 2 Plain Light Type Milling Machine

the control button gives maximum ease and simplicity of operation, and at the same time provides protection from coolant and accidental engagement.

The transverse and vertical adjustment handwheels are each automatically disengaged when power feed in the respective direction is engaged; for longitudinal adjustments, a safety hand crank is provided.

An automatic lubrication system in the knee provides intermittent oiling for all mechanisms in the knee. The table driving mechanisms, table ways and bearing surfaces at the top of the knee are lubricated at each movement of the longitudinal feed engagement lever. The one-piece knee screw is enclosed in a telescoping guard and is automatically lubricated.

Capacities are: longitudinal feed, 28 in.; transverse feed, 10 in.; vertical feed, 15 in. All feeds are automatic. On the Universal Machine, the centers swing 10-in. diameter and take 28-in. length.



B & S No. 2 Universal Light Type Milling Machine

"Time Saver" Grinder

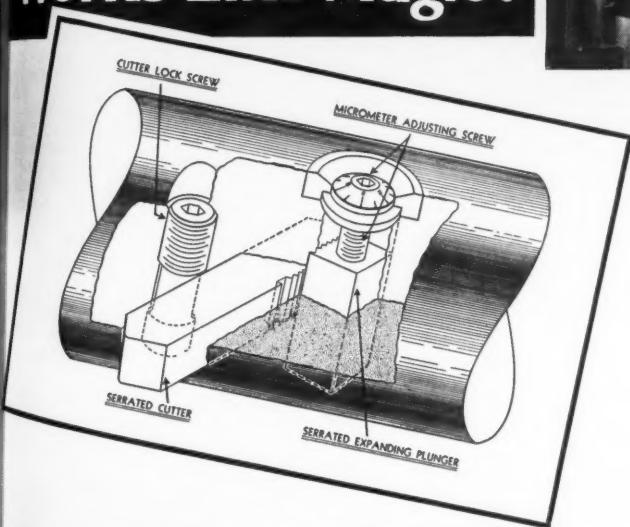
A cutter grinding machine designed to combine the highest possible efficiency with simplicity of operation has been developed

Am
B
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feed
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wide
large
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AUGUST

Amazing New DAVIS BORING TOOL Works Like Magic!



ACCURACY: Tool is precision built, assuring extremely accurate results.

INTERCHANGEABILITY: Uniformity of design and structure allow a rapid and accurate change of set-up.

RUGGED CONSTRUCTION: Permits with safety, increased speeds and feeds.

ECONOMICAL: Tools are universal in application, one tool covering a wide range of bores. Furnished in sizes for boring diameters $1\frac{1}{8}$ " and larger. Extremely effective with T. C. tipped cutters.

MICROMETER ADJUSTMENT: Minute adjustment permits as fine as .00025" adjustment on diameter.

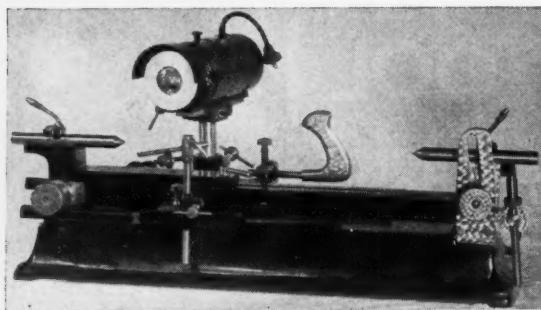
Send us prints of your work for a special recommendation incorporating this amazing tool!

DAVIS BORING TOOL DIVISION
LARKIN PACKER COMPANY, INC.
ST. LOUIS, U. S. A.

DAVIS BORING TOOLS

by Precision Engineering & Manufacturing Company, New Philadelphia, Ohio. The feature of the design consists in that the grinding wheel which

with diamond impregnated wheels, grinding fast, accurate grinding of carbide tools and resulting in longer life between grinds.



"Time Saver" Grinder

is mounted on a carriage oscillating on ways provided on the base of the machine, is moved lengthwise of the cutting edge instead of crosswise. The machine is designed for the grinding of spiral, concave, convex, straight, and all of the other different types and kinds of cutters, reamers, taps, mills, and so on.

The machine can be set up in an exceedingly short space of time and the work may be ground on the straight to any taper desired and back to straight again without removing centers. To make this feature possible, the work centers are mounted on an arm hinged at one end and provided with a quick-change rising adjustment (graduated in degrees) at the other. An additional threaded adjustment at the rising end is said to make perfect micromatic adjustment possible on any angle at all times.

The motor is so located that it may be raised or lowered, adjusted from side to side, or turned completely around to obtain any necessary angle. The motor is also secured to a bracket mount, hinged at one end and provided with a knurled screw adjustment at the other, making possible a micromatic setting for cutting the depth of the wheel.

Ex-Cell-O Carbide Tool Grinder

A low-cost carbide tool grinder designed to bring the advantages of high-priced special carbide grinders within the range of smaller shops has been announced by the Ex-Cell-O Corporation, 1206 Oakman Blvd., Detroit, Mich. Features include the use of wet grinding

It is anticipated that diamond wheel machine will not only be within the means of small shops in buying but few carbide tip tools, but will also enable larger users of such tools to locate a number of smaller grinders around the plant nearer to production machines, thus resulting in increased tendency on part of the operator to keep his tools sharp, with lowered carbide tool costs, increased production and avoidance of time-loss taking tools to central departments for sharpening.

The grinder is a single end, self-contained machine, with a ball bearing spindle and a built-in coolant reservoir. A completely adjustable table, angle setting dial and protractor permit sides, radii and angles of round and rectangular right and left hand tools to be rapidly ground.

A dial with graduations clearly visible to the operator without stooping



Ex-Cell-O Carbide Tool Grinder

permits him to set the angle of the wheel accurately. The dial allows any angle from 90 to 115 deg. between the wheel face and table to be obtained. The rest table has a slot for guiding a protractor, which is also graduated in degrees.

A drum-type switch, conveniently mounted at the front of the grinder

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t, 1938



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● It's just like taking a vacation when you pack up your stock worries and turn them over to your Union Drawn Distributor.

From then on you will be free from the worries and cares of keeping up your stocks of cold finished bars and shafting. No more need you gamble on what your needs will be tomorrow. No more need you fret over delivery time on rush orders. No more need you fuss with inventories nor pay the penalties exacted by tied up capital and storage space, depreciation, insurance and labor and overhead costs.

Start your year-round vacation right now by getting acquainted with your Union Drawn Distributor. He may be but a short distance from your plant. Never is he more than a few hours' hauling distance away.

He carries large classified stocks of dependable quality cold finished bars and shafting—ready to deliver to you when you need them. He can help you, too, in recommending the proper steel for the job and the best method of processing it.



UNION COLD DRAWN STEELS

AUGUST, 1938

MODERN MACHINE SHOP 101

controls starting, stopping, and hand of wheel rotation. The spindle is journaled in ball bearings at front and rear. An electric motor, adjustably mounted inside the machine base, drives the grinding spindle through a V-belt. Belt replacement and tension adjustments are made by lifting a guard at the rear.

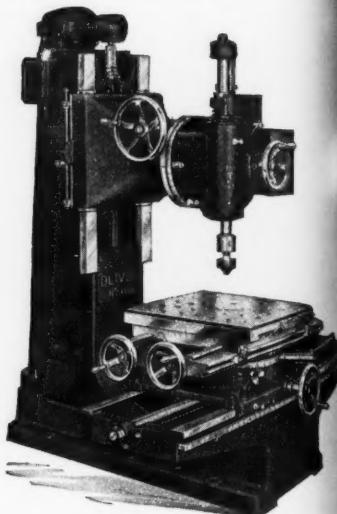
The coolant reservoir is a compartment at the top of the main machine base casting. It is connected through an adjustable needle valve to an applicator which distributes a light film of coolant on the abrasive surface of the wheel. A large chip pan is a part of the machine base.

The overall height of the grinder is 14 $\frac{1}{4}$ in.; width, 13 $\frac{1}{2}$ in., and depth, 20 $\frac{1}{8}$ in. Bottom of base to spindle center is 11 $\frac{1}{8}$ in. Spindle driving motor is $\frac{1}{4}$ h.p., 1725 r.p.m., 110 volt, 50 or 60 cycle. Approximate weight, 135 pounds.

"Oliver" No. 103 Universal Pattern Miller

A pattern-making machine which is said to be to the pattern maker what the universal milling machine is to the tool maker has been placed on the market by Oliver Machinery Company, Grand Rapids, Mich. The machine is

intended for the machining of boxes, regular and irregular patterns, and for recessing and routing, and slotting, facing, gear cutting,



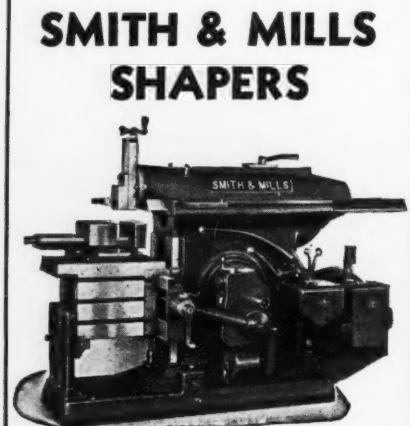
"Oliver" No. 103 Universal Pattern Miller

tising, shaping squares, tenoning, tailing, and so on.

The machine consists primarily of a floor plate on which are mounted a column carrying the arm and head of the main slide which carries the table. The column is of the cored type, wide and deep and amply braced for rigidity. On top of the column is mounted a $\frac{3}{4}$ h.p. geared motor which operates a screw that raises and lowers the table. The arm carries the head and a $\frac{1}{2}$ h.p. speed, 3600 or 1800 r.p.m. motor driving the spindle. Power is transmitted to the spindle by belt and by changing the belt to the second set of grooves on the pulleys, four speeds can be obtained as follows: 4000, 2900, 2200 and 1450 r.p.m.

The spindle is of alloy steel and mounted in precision ball bearings. The head is offset so that core boxes 7 in. and larger can be cut with the spindle in horizontal position. The distance from the center of the spindle to the face of the column is 30 in. Extreme height in vertical position of spindle from the top of the table is 20 in. with spindle horizontal, 22 in. The maximum table movement is 54 in.

The table is graduated in 1-in. in-



Automatic lubrication—forced feed. Multiple disc clutch and brake. Quick feed changes. Direct reading feed and stroke dials. Power rapid traverse to cross feeds.

THE SMITH & MILLS CO.
CINCINNATI OHIO

Note the uniformly accurate set of Tuf-Flex teeth and their sharp edges, making for smooth, clean cutting.



TUF-FLEX *can take it*

TUF-FLEX sure is tough. This sensational new-comer into the hack saw world already has the old-timers rubbing their eyes in amazement. There's nothing like it. It's not only mighty tough and flexible, but also super-hard. Abusive treatment on the thinnest sheets, tubing or gutter pipe, and punishing side strains mean nothing to it; the teeth don't strip and the blade just doesn't break. Equally effective on large sections.

The secret of its phenomenal success is a new alloy, exclusive with Millers Falls for hack saw use. That's why a blade with a back that Rockwells C 60 can be safely abused as shown above.

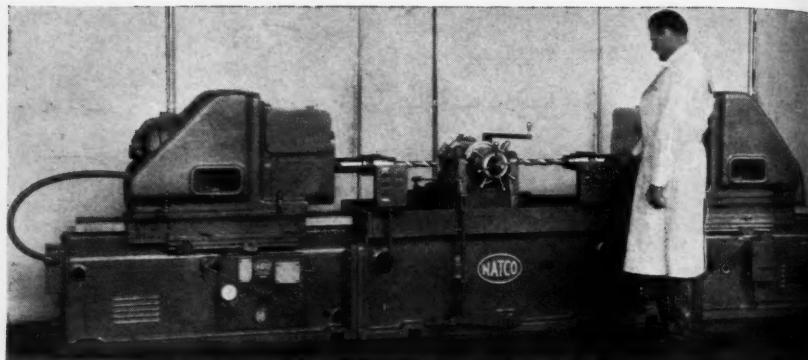
Tuf-Flex is guaranteed to be the most economical general purpose blade ever developed. Its performance on any class of work is remarkable. A trial in your own shop is certain to convince you.

Photomicrograph of the superior alloy steel used in Tuf-Flex blades showing remarkably uniform grain structure. Teeth have same grain structure as the body.



MILLERS FALLS COMPANY

Greenfield, Massachusetts



Natco Two-Way Drilling Machine

tions on the top to facilitate centering work and is mounted on a ball bearing swivel carriage, graduated in degrees and fitted with a taper plunger with which it is automatically locked at every 15 degrees. The height of the table from the floor is 34½ in. Height overall is 87 in., and floor space required is 6x6½ ft. Weight, crated, 4500 pounds.

Natco Two-Way Drilling Machine

Shown in the illustration is a Natco Two-Way Machine recently designed and built by National Automatic Tool Co., Richmond, Ind., for a prominent airplane propeller manufacturer. The machine is built of two Natco Holesteel Floor-Type Units, each complete with a single spindle head and a single indexing type fixture arranged to hold either one of two large steel hub cams. The fixture, in addition to having ten radial locations, may be located in three different positions on the horizontal axis. By indexing the hub cams and changing the tools, the required operations

are performed.

The operations are as follows:

Set-up No. 1: (1) Drill two opposite cam track end holes. (2) Index 90 degrees. (3) Drill two opposite cam track end holes. (4) Index. (5) Drill two opposite cam track end holes. (6) Index 90 degrees. (7) Drill two opposite cam track end holes. (8) Unload.

Set-up No. 2: (1) Change index drum. (2) Drill two opposite "A" holes. (3) Index 90 degrees. (4) Drill two opposite "A" holes. (5) Index and change tools. (6) Drill two opposite "B" holes. (7) Index 90 degrees. (8) Drill two opposite "B" holes. (9) Index 90 degrees. (10) Drill two opposite "C" holes. (11) Index 90 degrees and remove one drill. (12) Drill one opposite "C" hole. (13) Take out drill and place reamer in second spindle. (14) Ream one opposite "C" hole. (15) Index 90 degrees. (16) Place reamer in second spindle and ream two opposite "C" holes.

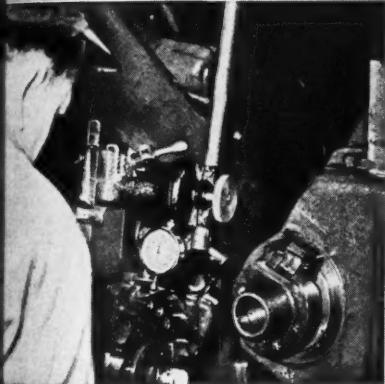
The machine is shown complete with hub fixture and drills in position.



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Arbor Presses
500 lbs. to 35 tons pressure
HYDRAULIC, MOTOR DRIVEN, HAND OPERATED
Greenerd Arbor Press Co. Nashua, N. H.



STARRETT DIAL INDICATORS for Every Requirement



Left: Checking the teeth of a broach with a Starrett LAST WORD Dial Indicator.

Top right: Setting up a Gleason Hypoid Gear Cutter with a Starrett Dial Indicator Model 25T-2.

Bottom right: Inspecting thread chasers with a Starrett Dial Indicator No. 25-A mounted in a special fixture.



For information on the complete line of STARRETT and LAST WORD Dial Indicators, see Starrett Dial Indicator Catalog MD (Second Edition). A copy free on request.

THE L. S. STARRETT CO., ATHOL, MASS., U. S. A.

World's Greatest Toolmakers — Manufacturers of Hacksaws Unexcelled — Steel Tapes, Standard for Accuracy — Dial Indicators for Every Requirement

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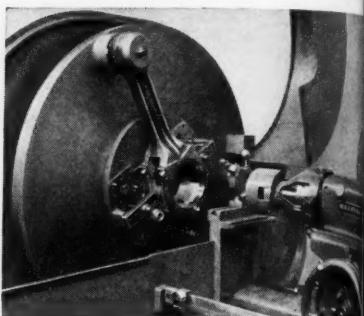
Heald No. 174 Adjustable Gap Internal Grinding Machine

Work having swing as great as 42-in. diameter with holes up to 20-in. diameter can now be internally ground on the No. 174 Adjustable Gap Internal Grinding Machine recently brought out by The Heald Machine Company, Worcester, Mass. The machine is of large and powerful construction, with low work center due to the gap design. The machine is equipped with a 50-in. face plate, 4-in. raising blocks under the work head, workhead cross slide, especially large water guard, hand wheel table feed, and other special equipment. The base is a heavy L head casting which provides rigid support for the workhead and work. The end of the base is stepped down and provided with two carefully scraped flat ways on which a massive bridge holding the workhead can be moved to obtain an adjustable gap. The ways of the base are pressure lubricated. The oil reservoir in the lower part of the base is completely enclosed to eliminate possibility of entrance of dirt or foreign matter. A Purolator unit insures pure oil in the hydraulic system.

The main table travels on flat and

ent reach of the operator. The table speeds can be varied from 0 to 32 per minute.

The workhead spindle is of general



Heald No. 174 Adjustable Gap Internal Grinding Machine Set Up to Grind Diesel Engine Connecting Rod with 22-In. Center Distance

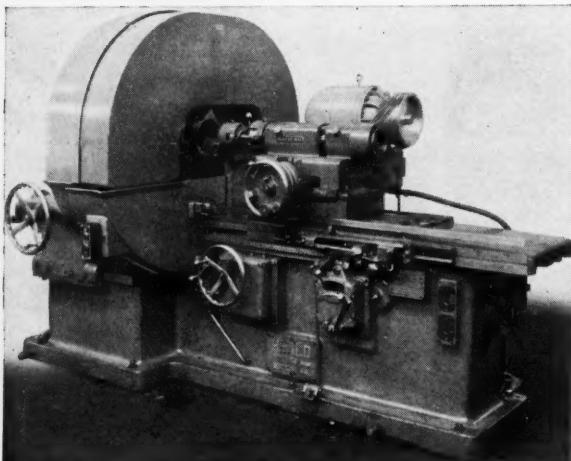
size and runs in large, preloaded anti-friction bearings. The workhead is stopped instantly by means of a solenoid brake on the workhead motor shaft.

A hole through the spindle provides for a collet operating tube which can be adapted to operate collets or special holding fixtures of either the draw or push type. A generous flow of coolant is directed over and through the work.

The gap, or swing clearance for the work, can be adjusted to suit all types of work by lateral movement of the bridge and workhead unit on the ways. The wheel trueing device can be operated so that the diamond trues the wheel just before the final size is reached, thus providing a clean, sharp wheel. The cross slide which carries the wheel head and wheel head motor is mounted on a solid base bolted to the machine table and the

wheel head is driven direct by a flexible coupling from a jack shaft belt to the wheel head motor. This construction eliminates the possibility of chatter in the wheel head spindle.

A coarse feed for the wheel can be set for rough grinding to within a given



Heald No. 174 Adjustable Gap Internal Grinding Machine

V-ways which are fully protected at all times. The table is driven by a simple hydraulic arrangement, allowing for complete control of speeds or direction of movement at all times. Push button control switches for the wheel head and back shaft motors are within conveni-



Bronze Retainers for Longer Wear

One of the many reasons why McGILL Precision Ball Bearings wear longer is their special ball retainers. Made of special McGILL Bronze, they offer least resistance to steel balls—least friction. The balls do not wear out of round or undersize before their time. McGILL Bronze dissipates heat quickly, too, preventing crystallization and insuring cool running. And McGILL Bronze means quiet running. Include McGILL Bearings in your products for longer wear.

The McGILL line comprises a complete range of ball bearings—plus McGILL MUL TI ROL Bearings, the original needle type. Special types gladly designed to meet individual requirements.

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Use McGILL—the Bearings with the *Bronze Retainers*

McGILL MANUFACTURING CO.
1500 N. Lafayette St.
VALPARAISO, INDIANA

limit of finished size at which point the roughing feed automatically changes to finishing feed. The hydraulic pump is of gear type design, built for high pressure duty, and connected by a flexible coupling to its own motor. Three motors are furnished as standard equipment: for the workhead a 2 to 3 h.p., 690 to 2070 r.p.m., D.C. motor which provides a wide range of speeds; for the wheel head a $7\frac{1}{2}$ h.p., A.C. motor of 3450-3600 r.p.m., and for the pump a 2 h.p., A.C. 1200 r.p.m. motor. If desired, all three motors can be supplied for direct current. All motors are controlled by push button switches within convenient reach of the operator.

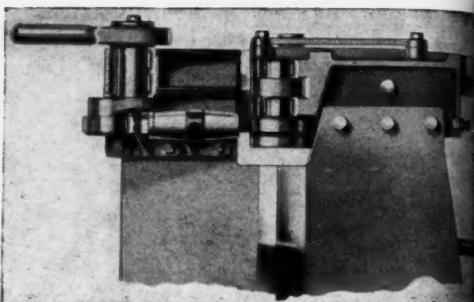
The swing inside the standard water guard is 42 in. and the maximum diameter of hole that can be ground is 20 in. Table speeds unlimited between 0 and 32 ft. per minute. Workhead speeds, 74, 112, and 148 r.p.m. with A.C. 60 cycle motor or 85 to 167 r.p.m. with D.C. motor. Floor space required with water tank, 150x66 in. Weight of machine, net, 16,000 pounds.

Whitney-Jensen Roller Bearing Bending Brake

Whitney Metal Tool Company, 91 Forbes St., Rockford, Ill., announces a Whitney-Jensen Bending Brake, the design of which includes roller bearings at the several most important points. A substantial reduction in the effort required to operate the brake is realized, thus speeding up the operation and cutting down on the operator's fatigue without diminishing the accuracy or

power of the machine.

Full-floating, lifetime-lubricated, needle-type roller bearings are to be found in the apron supports, at the upper

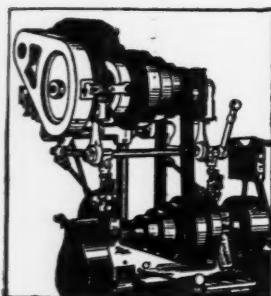


Cutaway view of one end of the Whitney-Jensen Bending Brake, showing needle-type bearing in apron supports, at the ends of toggles, and on eccentric shafts.

of the toggles, and on the eccentric shafts. Compared with a similar brake having bearings of the older type, it shows a reduction of 12 to 14 per cent in the force required to press the seams and a reduction of 90 per cent in the force required to release the clamping handle from over-center position.

Mattison High Power Precision Surface Grinder

To meet the need for grinding equipment designed especially for grinding long V and flat way surfaces, base plates, and other large, precision work such as machine tool work, Mattison Machine Works, Rockford, Ill., has developed a large, powerful and accurate grinder to be known as the Mattison.

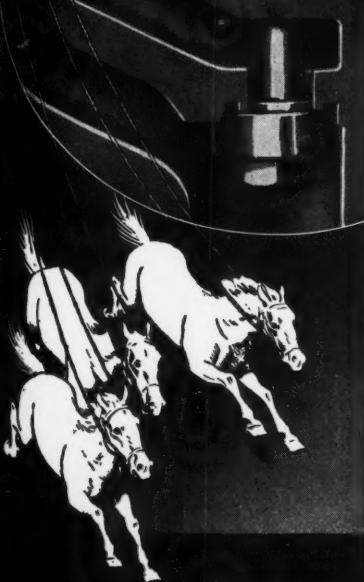


MOTORIZ for better light

Give employees better working conditions. They produce more — spoil less. Oust light-obstructing overhead shafting and belting. Install Remco Motor Drives. Remco's standardized construction lowers its price—makes 3 day deliveries ordinarily possible. New broadside available—get your FREE copy—write! Remco Products Corp. State & High Sts., York, Pa.

REMCO MOTOR DRIVES

ROSS Air Control VALVES with POSITIVE SEAL NO LEAKAGE



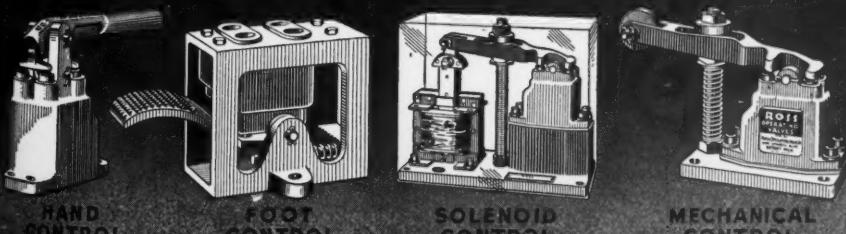
Positive seal of valve seats is assured by full line air pressure. Metal cup washers, in which synthetic, oil resistant rubber has been permanently vulcanized, afford perfect seating, prevent leakage and give exceptionally long life.

All ports on one face permit gang mounting in minimum space—easy to install. Short throw makes Ross the ideal valve for mechanical control. For easy, positive action, and speed in the operation of your air actuated equipment, install Ross valves.

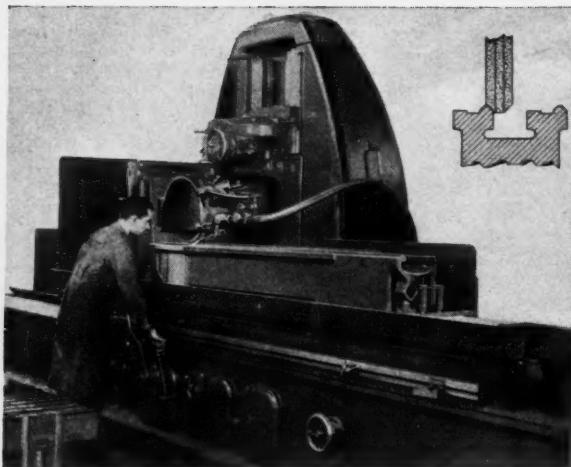
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ROSS OPERATING VALVE CO.
6484 Epworth Blvd. • Detroit, Michigan

THE BRIDLE FOR AIR HORSEPOWER



A SIZE AND TYPE FOR EVERY OPERATION



Mattison High Power Precision Surface Grinder Grinding Way Surfaces After Flame-Hardening

High Power Precision Surface Grinder. With this machine it is said that hardened V and flat ways can be ground to extreme limits of accuracy and smooth

finish. The grinder is built with a table large enough to accommodate most jobs. A wheel truing device mounted on the wheel side permits trueing both angles of the wheel for grinding V-ways.

The machine is especially adaptable for grinding lathe beds which have been hardened by the "flame-hardening" process. The illustration shows a Mattison High Power Precision Surface Grinder grinding the way surfaces to precise accuracy and fine finish after completion of the flame-hardening process.

Hisey Electric Tool Post Grinder

The Hisey-Wolf Machine Co., Cincinnati, Ohio, has developed a new line of electric tool post grinders, one of which is illustrated herewith. The machine

Our representatives will give you particulars.

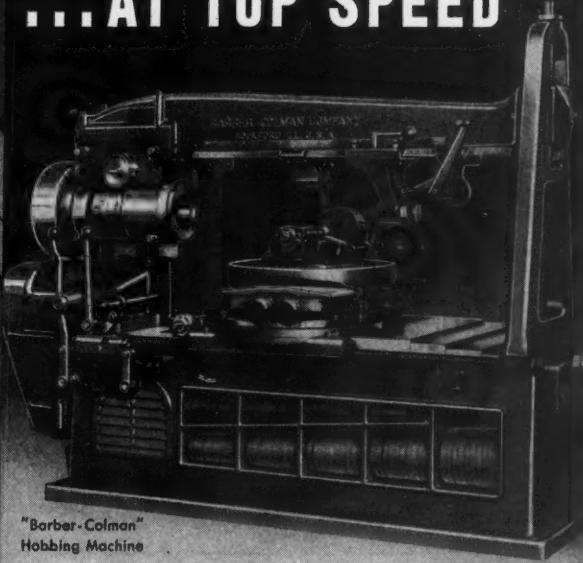
Boston—Gen'l Mach'y Corp.
 Buffalo—R. C. Neal Co., Inc.
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 Cincinnati—D. B. Hubert
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● A PROLONGED HIGH-SPEED RUN! Any interruption . . . any shutdown . . . may perhaps mean an entire production schedule shot. Back a few years, you might have had cause to worry. But now, any machine can be equipped with the modern **BIJUR AUTOMATIC LUBRICATING SYSTEM**. Each bearing kept bathed in its correct oil film . . . continuously . . . automatically. With BIJUR installed, your mind is free. Lubrication troubles automatically dismissed!

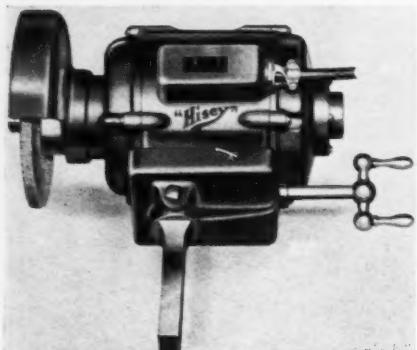
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are said to be new in every detail, the design embodying many electrical and mechanical refinements.

Precision ball bearings are used



Hisey Electric Tool Post Grinder

throughout, mounted in accurately ground housings. Power is supplied through commutating type impulsion-induction motors for single-phase service. Double lock nuts are used through-

out, permitting operating the machine in either direction of rotation with safety. Spindles are of heavier design as are also the wheel arbors. A square thread set screw is used, also an extensible connector.

The grinder is designed to be attached to the tool post of a lathe, the vice of a milling machine, or the head of a shaper, planer, boring mill, or other machine. It is built in $\frac{1}{4}$ and $\frac{1}{2}$ capacities with horizontal slide adjustment as shown. The grinder can also be supplied without the slide feature.

Hannifin "Hy-Power" Hydraulic Press

The Hannifin Mfg. Company, 611 Kolmar Ave., Chicago, Ill., has augmented its line of presses by the addition of the Hannifin "Hy-Power" Hydraulic Press shown in the illustration. The press which is of the general utility type with "Hy-Power" operating cycle, is available in capacities from $12\frac{1}{2}$ to 60 tons, for pressing, forming, crimping, stamping, shallow drawing, and similar operations.

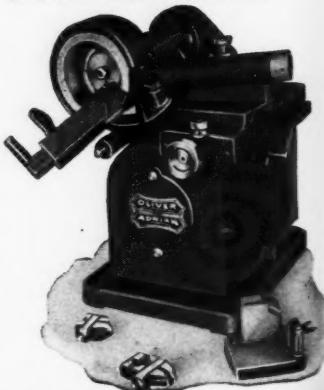
The press is a compact, self-contained unit adaptable to a variety of operations. The press illustrated has a capacity of $12\frac{1}{2}$ tons, and the complete operating

OLIVER OF ADRIAN

Drill Grinders Tap Grinders
Cutter Grinders Tool Grinders
Face Mill Grinders Point Thinner
Die Making Machines

will reduce your tool and cutter costs—grinding time, etc., BECAUSE tools, drills, and cutters ground the Oliver way last longer, they cut better, they produce more accurate work.

Oliver grinders will place your plant on a higher plane of efficiency. Send for literature.



Cut illustrates No. 21 Bench model drill grinder for small drills.

OLIVER INSTRUMENT COMPANY
1430 E. MAUMEE STREET ADRIAN, MICHIGAN

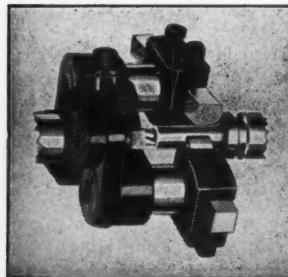
May We Save You \$235.00?

You pay \$300.00 for an assortment of right and left-hand tools.
You pay \$65.00 for 1 R & L Turning Tool that will produce the same
amount of work.

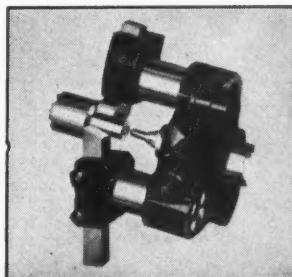
You save \$235.00!

Here's how your R & L Turning Tool can be used: for roughing and
finishing cuts, right or left-hand — as a balanced turning tool with two
cutting edges — as a combination turning and burnishing tool — for
simultaneous drilling and turning. This tool can be changed from
Right to Left or Left to Right in ten seconds — an exclusive patented
feature.

Let us show you how to save \$235.00 — Write today for information.



Turning and
Centering

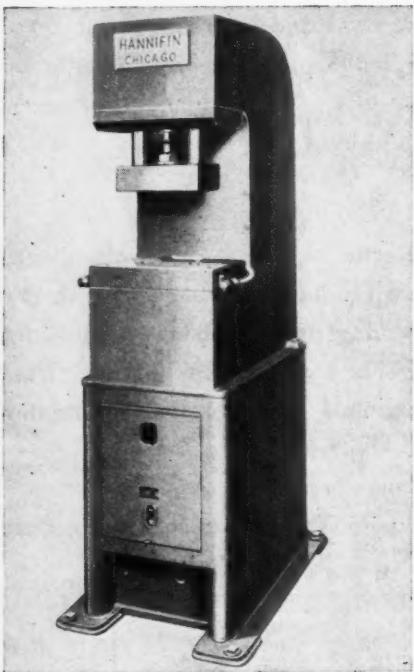


Turning one diameter —
chamfering two corners,
facing end of part along
with drilling or reaming.

R & L TOOLS

1825 BRISTOL STREET
NICETOWN
PHILADELPHIA, PA.

cycle is approximately two seconds. "Hy-Power" hydraulic operation provides an automatically completed press cycle when the push button control is pressed. The cycle includes: (1) rapid advance



Hannifin 12 1/2-Ton "Hy-Power" Hydraulic Press

stroke until the die touches the work; (2) automatic high pressure working stroke; (3) automatic reversal at maximum pressure, and (4) rapid return to

starting position. The oil pump maintains zero pressure between cycles.

The "Hy-Power" hydraulic pressure generator is driven by a 2 h.p. motor. The 12 1/2-ton press and is located in base of the press. The pressure generator unit is mounted on casters and may be removed by disconnecting pipes. Only electrical connections required for installation of the press.

Operation is controlled by two push buttons at the sides of the table. Push buttons must be held down to operate the press, thus insuring that the operator's hands are clear. Pushing both buttons causes the ram to operate through one cycle. An instant stop is provided. Releasing either control button at any point in the cycle stops the ram and returns it to its position.

The "Hy-Power" operation automatically provides the high pressure working stroke and reversal of the ram, controlled by pressures needed during ram stroke. This feature removes the necessity for close vertical die adjustment and, with the smooth hydraulic action, is said to result in longer life.

Specifications are as follows: capacity 12 1/2 tons (similar presses available in capacities up to 60 tons); stroke, 3 1/2 in.; table to platen (up), 9 in.; center ram to face of frame, 7 in.; platen (gilded), 6x10 in.; table, 10x15 in.; base, 22 1/2x34 1/2 in. The "Hy-Power" hydraulic pressure generator is driven by a 2 h.p. motor.

P&H-Hansen 200-Ampere "Special" Arc Welder

The Harnischfeger Corporation, 4 W. National Ave., Milwaukee, Wis., announces to the welding industry the P&H-Hansen 200-Ampere "Special" Gine-Driven Welder. The machine is built in answer to the demand for

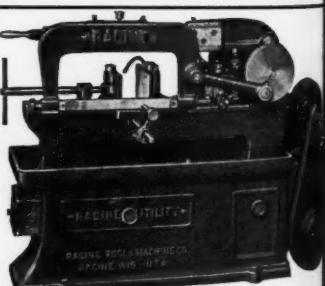
RACINE

The New Utility Saw-Hydraulic Feed

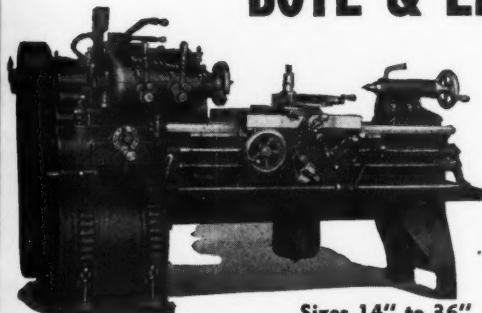
High efficiency at a remarkably low price.

"Standard the World Over"

Racine Tool & Machine Co., Racine, Wis.



Smooth-Powerful-Accurate BOYE & EMMES LATHE



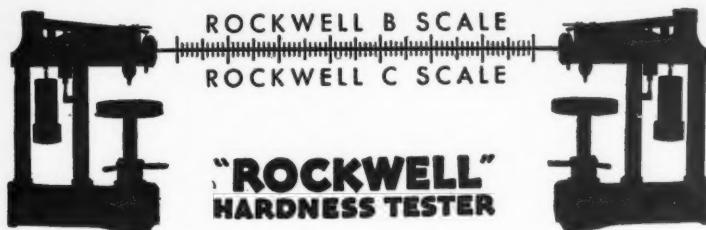
Sizes 14" to 36"

BOYE & EMMES Lathes will deliver the finest kind of lathe performance you've ever known, and they'll keep on delivering year after year. That's the result of experienced engineering . . . quality construction . . . and strict attention to every detail.

Write today for complete information.

**THE BOYE & EMMES MACHINE TOOL CO.
CINCINNATI, OHIO**

"The Lathe With The Longer Life"



**"ROCKWELL"
HARDNESS TESTER**

In addition to all the testing done on these machines for control of heat-treating or for experimental testing, thousand of plants use our testers for specification purposes. To be useful for that, they had to be sensitive and accurate, and both buyer and seller had to have them. "ROCKWELL" Testers are now so extensively used you may count on the other fellow having one too.

WILSON MECHANICAL INSTRUMENT CO., INC.

Concord Ave. and 143rd St.

New York

AUGUST, 1938

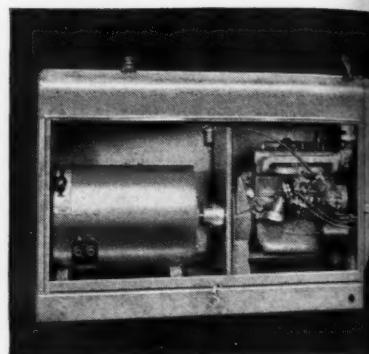
MODERN MACHINE SHOP 115

engine-driven welder with a somewhat wider operating range than the average 150-ampere unit, yet lower in price than the standard 200-ampere unit.

Consisting of a 200-ampere, commercial rated 30-volt 6 kw. generator with an intermittent welding range of 35 amperes to a maximum of 225 amperes, the "Special's" generator is connected by a flexible coupling to a 24 h.p., four-cylinder, water-cooled gasoline engine. The engine is equipped for hand-starting and with magneto ignition system.

The entire unit is mounted on a formed steel base and equipped with a fully enclosing sheet metal canopy hav-

ing removable sides for easy access to all parts. Although in its standard form the "Special" is a stationary type machine, it can be supplied with standard P&H two-wheel pneumatic tire running gear as now used on



P&H-Hansen 200-Ampere "Special" Welder

P&H 150-ampere portable, engine-driven welder.

The "Special" is built to handle electrodes up to 7/32 of an inch in diameter under continuous manual operation. Equipped with a Continental motor, the type used on agricultural equipment all over the country, it is therefore easily serviced machine—an item of serious consideration, especially in outlying districts where the agricultural equipment dealer is likely to be the source of parts.

Martin Master Collet

The Modern Collet and Machine Company, 401 Salliotte St., Ecorse, Mich., introduced a master collet to be used



Pioneers in the riveting field. Head rivets from smallest to $\frac{3}{8}$ " diameter, either by noiseless spinning or vibrating hammer method.—Sizes to meet all needs.—Types include Vertical and Horizontal Multiple Spindles.

Write for literature — and don't forget to send samples.

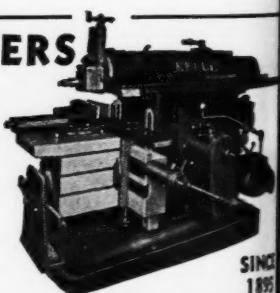
THE GRANT MFG. & MACHINE CO.
96 Silliman Ave. Bridgeport, Conn.



CRANK SHAPERS HEAVY DUTY

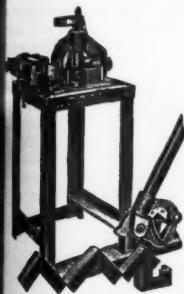
Made in six sizes from 16" to 36" stroke, with motor or single pulley drive. Timken Bearings throughout. Revolving Table. Semi-automatic pressure lubrication. Centralized control. Stroke and feed adjustment during operation. Thoroughly guarded to protect operator and machine. One year guarantee.

GENERAL ENGINEERING & MFG. CO.
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Shears, Notches
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iron in one minute
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capacity 1/2" thru
1/2" iron.



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TORNADO
Portable
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The Most Powerful Portable Blower Ever
Built—Blows Dry Air at 275 M. P. H.
One small machine and attachments with tremen-
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airblast—completely removes dust and dirt
from motor and machinery. Prevents over-
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uses.

Let us show you how cleaning can be done
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IRREGULAR SURFACES
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MODEL 25

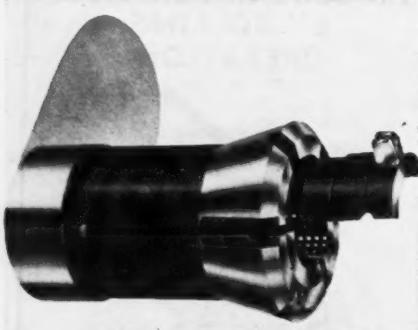
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This machine operates from your plant air
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Hi-Duty marking machines may be had for
practically any marking operation, and we will
be glad to make recommendations upon receipt
of your inquiries. Send prints or samples of
parts to be marked, showing lettering and
location, also state required production.

GEO. T. SCHMIDT, Inc.
1806 BELLE PLAINE AVE.
CHICAGO, ILL.

as the Martin Master Collet. According to the manufacturer, this collet provides an entirely new principle of collet design which offers definite savings in initial costs and also effects unusual production economy.

The two principal objections to the



Martin Master Collet

use of master collets in the past has been in the loosening of pad screws—sometimes to such an extent that the pads would drop entirely out of the collet—and the fact that considerably more time was involved in changing from one size to another than when solid collets were used. The Martin Master Collet overcomes both of these objections.

By reason of its special construction, with the pad screws as integral parts of locking wedges which fit tightly into the end of the collet, the pads will positively not become loose. When it is necessary to change the pads, a few turns of the wedge screws permit quick removal—and with the collet still in operating position in the machine. Where formerly the time required to change

collet sizes was a matter of hours, Martin Master Collet can be converted to any new size within a few seconds.

An important feature of this collet is that the pads and the body of the collet are made of different steels, heat-treated separately. The pads are heat-treated to a hardness far exceeding that of the body and are made of specially selected wear-resisting steel. The body is made to offer the utmost both in toughness and resiliency throughout its entire length.

Ruthman Molten Solder or Hot Lead Pump

The Ruthman Machinery Co., 111 Front St., Cincinnati, Ohio, has brought out a pump in the design of which are some of the features of the standard Ruthman Gusher Pumps have been retained in addition to special features which have been developed where it is an important factor. This pump is to be known as the Model No. 1500, capable of safely handling water impurities with abrasives, there being no packing, metal contacts or bearings submerged in the liquid. The pump is designed to operate where the pressure is from 600 to 650 deg. F., specific gravity of approximately ten times that of water, and the natural hardening of metal when cool had to be taken into consideration.

To preclude the possibility of injury to the motor or the bearings as a result of the comparatively high heat, the heat dispenser was designed which consists of a series of aluminum fins mounted to the vertical shaft within an open lantern composed of components with fins between each. The lower anti-friction bearing is mounted within a separate lantern, 2 in. from the motor and directly above the heat dispenser.

The pump is provided with two

Set-up Time Becomes Production Time

Walker Magnetic Chucks save from 20% to 50% in chucking labor by eliminating slow-acting jigs and fixtures for metal removing operations on lathes, shapers, drills, presses, planers, grinders, etc. Write for catalog W 3.

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WORCESTER, MASS.



No. 618 Bar Pole Face Rectangular Magnetic Chuck
Available in sizes 4x8 to 30x96.

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steel.
utmost
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TIMES AS FAST



• This U. S. Multiple Drill Head drills four heads at once . . . does your drilling job 4 times as fast. With other U. S. heads, as many as 50 holes can be drilled at one time. Let us show you how to save money on special jobs.

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No grouping of three or four men to lift and struggle with heavy parts. The modern way of moving heavy parts to different levels. These tables are built by tool engineers who have long designed and produced special machine, dies, jigs and fixtures to exact specifications. No inquiries too small, no orders too large to receive our usual prompt attention.

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NOW A PLANER GAGE THAT ALMOST Talks

Those of you who have used an ordinary planer gage will be astonished at the variety of jobs the accurate Lufkin Master Planer Gage will do. It can be used as an adjustable parallel, with a sine bar for grinding angles, with gage blocks for building up work on a surface plate. In fact the new Lufkin Master Planer Gage can be used for countless jobs beyond the limits of all other planer gages.

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takes, one into the eye above and one into the eye below the impeller, and a venturi of generous size around the impeller housing chamber. The impeller, small in diameter, has special shaped blades to handle the heavy metals efficiently. The capacity is approximately 600 lbs. per minute. The flow can be throttled to any desired amount without building up pressure or overloading the motor.

The top motor frame is provided with lifting lugs, and the extension arms have key-shaped guides for raising the unit from the reservoir when not in

use. The pump is lowered again to the reservoir to resume operation when the solder or lead is in molten form. As an extra precaution, an asbestos



GRAY TURRET HEAD METAL CUTTER OR NIBBLER

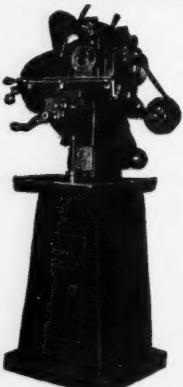


Cuts all metals any shape—
30 gauge up to 1".

GRAY, Originator of
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Cutter or Nibbler.
GRAY Cutters Still
Lead.

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Burke motor driven milling machines, Nos. 1, 2, 3, and 4, are specially suited for handling small, difficult work on a production basis.

Write for complete information.

BURKE MACHINE TOOL CO.

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Ruthman Molten Solder or Hot Lead No. 10.55

sheet, cut to fit snugly around the vertical arms, is mounted directly to the heat dispenser. Anti-friction bearings only are used and no packing glands are employed; thus maximum power is retained for pumping.

Gisholt Single Cutter Bar Turner

A single cutter bar turner for use on the No. 3, No. 4 and No. 5 Ram Type Universal Turret Lathes and No. 1L, 2L and No. 3L High Production Type Lathes is announced by Gisholt Machine Company, 1217 E. Washington St., Madison, Wis. The turner is said to have many features which make it particularly valuable for a manufacturer of bar work on turret lathes of the indicated.

The tool is said to answer the need for a turner that will take high quality cuts, maintain accurate dimensions and fine finish, and which may quickly be set up.

Tools are quickly set to center height above the plainly marked reference

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They are most satisfactory when used in WALTHAM CYLINDRICAL SUB-PRESSES where accurate alignment is not only attained but maintained. We can furnish these Sub-presses in nine diameters of plunbers. The arch type is used for strip punching with or without roll feed. Use the overhang type for second operation work requiring hand positioning.

WALTHAM MACHINE WORKS

Waltham

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NEAT STAMPING in NAME PLATES



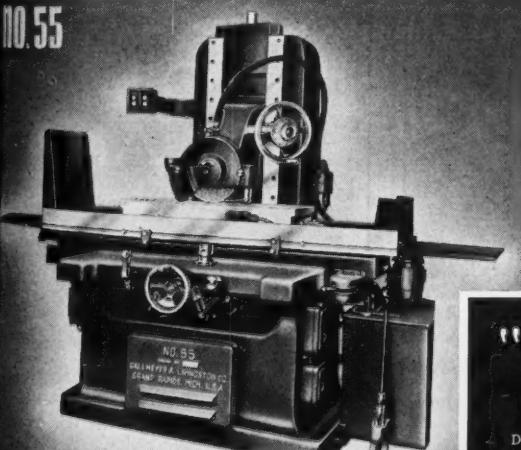
This machine quickly stamps details and serial numbers into name plates.

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GEO. T. SCHMIDT, Inc.

1806 Belle Plaine Ave., Chicago, Ill.

10.55



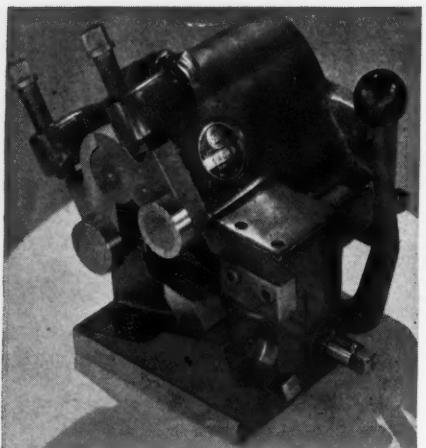
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PRECISION
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"GRAND RAPIDS"
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Designed to earn greater grinding profits in your plant . . . Table speeds up to 150 ft. p. m. with minimum power and wheel cost. Sizes from 6" x 18" to 24" x 144".

Write for catalog describing the finest, smoothest, fastest grinders we've ever built.



Gisholt Single Cutter Bar Turner

Setting to exact diameters is facilitated by a graduated micrometer screw. Rollers can be adjusted to lead or follow the cutter and when following they burnish the work to a high finish. Constant pressure is maintained between the tool

holder and micrometer screw. The cutting tool slot is of sufficient size to permit the use of high speed tools or shank cemented carbide tools.

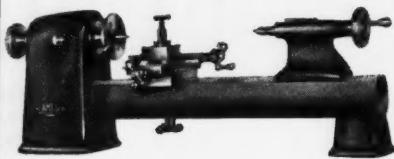
The operating lever retracts the cutting tool 1/32 in. to prevent damage when backing off the work. The cutter is held in a hardened steel tool block which is clamped rigidly to the column body by the cam action when in position. All working parts are entirely enclosed to prevent entrance of chips or dirt. The hardened steel rollers are mounted on needle bearings. The tool is integral with the base and is machined from the solid.

Portable Brinell Meter

A portable Brinell meter designed for the accurate determination of the hardness and tensile strength of ferrous and non-ferrous metals, independent of dimensions, is now being marketed. Louis C. Eltzen Co., 280 Broadway, York, N. Y.

The meter simultaneously makes impressions in a reference bar and in material to be tested. The standard reference bar is supported in contact with a standard 10 mm. steel Brinell block. The assembly is then placed in position on the surface of the material to

AMES BENCH LATHES



Precision lathes for doing most accurate turning, drilling, milling, threading, filing, polishing, in the tool room or in production.

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A Norgren Sight Automatic Air Lubricator feeds oil to the tool with the air that drives it. Operates on automatic lubrication. Adjustable from 1/2 to 100 c.p. to complete saturation of air stream. Ships on trial to any rated concern. Write for specifications and prices.

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NEW ABRASIVE BAND GRINDER . . .

"Built Like a Machine Tool"

The Hormel-M Grinder is sturdily built with supporting leg under the grinding table to eliminate vibration and tipping due to pressure on the belt. Ball bearing throughout. Equipped with ALEMITE LUBRICATION complete with grease gun.

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HORMEL-M GRINDER

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"NEW D&W" MAGNETIC CHUCKS

Styles 7x17 and 6x13



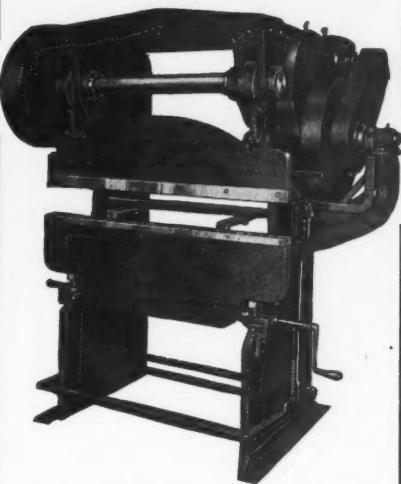
Developed to meet demand for chucks lower than our standard style.

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Does 40% to 60% of the forming work turned out by the average shop.

Here's a profitable, economical brake ideally adapted for rapidly forming metal sections such as in stoves, refrigerators, soda fountains, steel cabinets, metal furniture, steel boxes, and a great variety of sheet metal specialties. Its variable speed drive operates from 17 to 50 strokes per minute. The No. 253 CHICAGO STEEL PRESS is accurate, compact, and ruggedly constructed of highest quality materials.

Sizes 4, 5 and 6 ft. capacities, up to 10 gauge.

Write for Circular No. 253

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Spectacular Performance

MODEL ML—newest Do-All machine—does faster, smoother, more accurate work—both internal and external—on 48 different substances (up to 10" thick) from hardest high carbon steel to soft brass, copper, etc. Only machine in the world with this wide speed range—50 to 1500 feet per minute. Does jobs in one hour which formerly required a whole day.

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Work table 24" square, tilts four ways. Throat 16" deep. Weighs 1300 pounds. Requires 38x25" floor space.

Equipped with exclusive JOB SELECTOR—tells instantly speed and kind of accessory to use on every material; latest SPEED GAUGE; automatic BUTT WELDER; MOTORS; 20 BAND SAWS; 4 FILE BANDS; 3 POLISHING BANDS, etc.

The Do-All has been adopted by leading industries because it pays for itself in 4 months on an 8-hour production schedule.

Let us prove its worth. A factory-trained man will bring a Do-All to your plant and show you exactly what it does, what it saves, on your own work.

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CONTINENTAL MACHINES, INC.
1306 S. Washington Ave.
Minneapolis, Minn.

tested and a plunger within the instrument is given a sharp blow with a hammer. The Brinell ball produces a simultaneous impression in the bar and the surface of the material under it, after which the impression diameter are compared and, by reference to direct-reading hardness table provided for the purpose, the Brinell hardness of the material is quickly noted and



Portable Brinell Meter

tensile strength of the material quickly be computed. The outfit is closed in a 6 1/2 x 9 1/2-in. carrying case and weighs 6 1/2 pounds.

Ideal Select-O-Speed Variable Speed Transmission

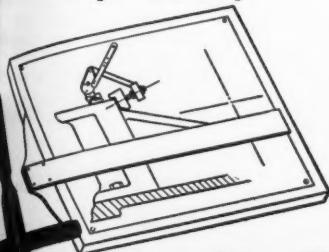
The Ideal "Select-O-Speed" Transmission, as illustrated, is a new, entire different type that is very inexpensive and uses only standard "V" belts and easily gives an infinite selection of speeds over a 5 to 1 or greater ratio by a simple movement of the control lever.

The "Select-O-Speed" modernizes equipment. It is applicable to all machinery that is now operating at a fixed speed when a variable speed is necessary or desirable. Compact and flexible design makes it easy to build this transmission into the original design of new equipment. Several sizes are available up to 7 1/2 h.p.

The variation of the speed ratio is made possible by a very ingenious

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Investigate and Specify
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KNU-SINE UNIVERSAL ACTION TOGGLE CLAMPS

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3 and 4-Way Control Valves



3 and 4-Way Control Valves for operating single or double acting air, steam, water or oil cylinders. Made in lever, foot, solenoid and motor operated. All pressures up to 3000 lbs. Bulletins on request.

Other Products: Arbor Presses, Flexible Couplings, Steel and Stainless Ball Floats, Steam Traps and Separators, Air Separators, Traps and Vents, Etc.

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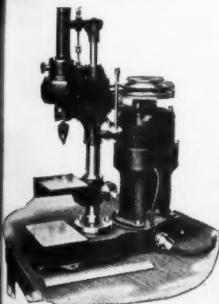
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YOUR SAMPLES RIVETED GRATIS

You have a riveting problem. You may wonder what rivet to use, how much to leave for heading, etc., etc.

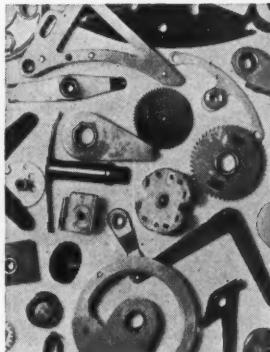
Why bother your head about it. Send us a sample, preferably several, with rivets if you have them, and we will rivet them for you, returning them promptly. We will also recommend proper equipment and cost.

No obligation whatever.



HIGH-SPEED DRILLING MACHINE

A super-sensitive machine of great precision. Capacity to $\frac{1}{2}$ ". Thousands in use on all types of tool, die and model work; also on manufacturing of Aviation and all other instruments, shutters, etc.



HIGH SPEED HAMMER CO., Inc.
307 Norton St. Rochester, N. Y.



There's a
High Speed
for any
Rivet

Made in ten sizes
for rivets from the
Smallest to 3" di-
ameter.

simple arrangement of two interlocking sheaves. These sheaves may be pivoted laterally by a slight movement of a con-



R. W. F.
Ideal Select-O-Speed Variable Speed Transmission

trol lever, thus changing the driving and driven belt tensions. This change automatically causes the sheaves to adjust themselves to a new pitch diameter for the new speed ratio, and gives the

infinite speed variation that is necessary for proper machine control.

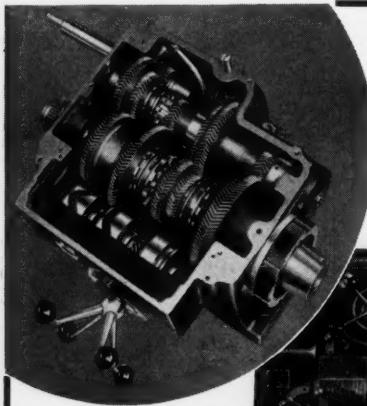
Construction is simple and rugged—ball bearing throughout—with a minimum of wearing parts. Installation is as quick and easy as any "V" belt. It may be mounted on the floor, ceiling, upside down or right-side up, and it works without noise or vibration in any position.

The Ideal Select-O-Speed Transmission is made by the Ideal Community Dresser Co., 1031 Park Ave., Syosset, Illinois.

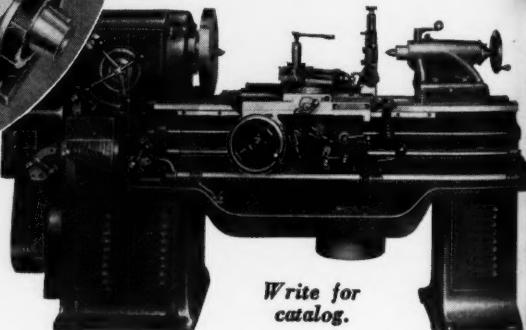
Ohio Type V00 Vertical Double Speed Reducer

The newest addition to the Ohio line of speed reducers made by Gear Company, 1333 East 179th Street, Cleveland, Ohio, is the small vertical double speed reducer illustrated with. The outside dimensions of $4\frac{1}{2} \times 4\frac{1}{2}$ in. make this reducer particularly useful where space is at a premium.

Input and output shafts are at angles in either the horizontal or vertical plane. A special advantage exists in the fact that a variety of options for the input and output sha-



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All-Herringbone Transmission Only in SIDNEY Lathes

An all-herringbone transmission, composed of 12 continuous-tooth gears, completely eliminates all gear tooth or tool marks from the work. Controlled by Monotrol (1 dial) or Trisit levers. Sizes 14" to 24".

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"First Aid" Kits of

WALTON TAP EXTRACTORS

ARE A SHOP NECESSITY WHEREVER TAPS ARE USED



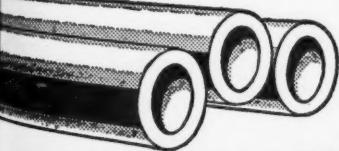
They remove taps broken at or below the surface of the hole easily, quickly and without injury to the threads.

Send for Folder 132 giving sizes, styles and prices.

Test their worth by 30-day Free Trial.

The Walton Co.
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Don't waste time and money in drilling from the solid . . . Order BISCO TOOL STEEL TUBING.

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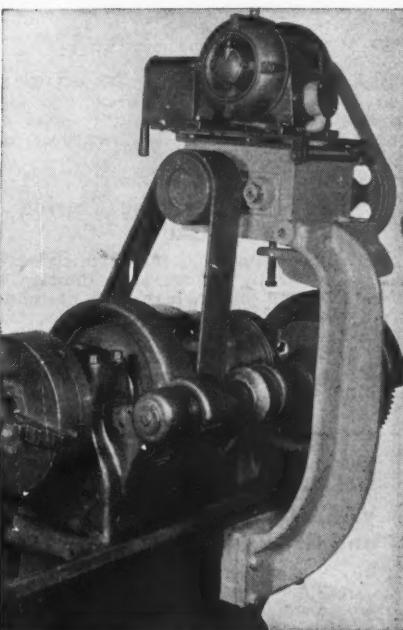
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Choose the Correct Type for Your Application

Don't judge by price alone as the lowest priced drive may not only fail to meet your full requirements, but also may prove expensive in the long run.

A proper design for driving a wide range of machine tools requires consideration of many factors. To meet these requirements we offer FOUR different designs. Our sales data outlines the limitations of each type, so you can readily select the design you prefer.

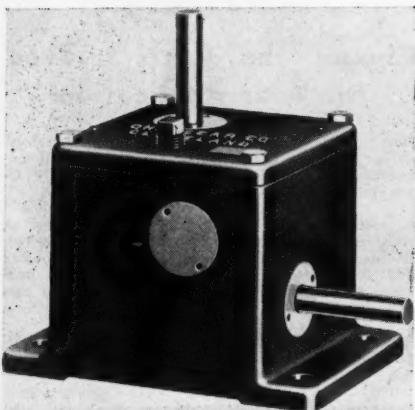
Write for Form 646 which we believe you will find of definite assistance to you in motorizing your tools.



The Production Equipment Co.
5219 Chester Ave. Cleveland, Ohio

possible without changing the mounted position of the gear box. All gears are of SAE 65 Bronze. Either ball or Timken bearings are available. Shaft sizes are $\frac{1}{2}$ in. standard.

For torque capacity of 100 inch-pounds,



Ohio Type V00 Vertical Double Speed Reducer

ratios are 100 to 1, 200 to 1, 300 to 1, 400 to 1 and 800 to 1. For torque capacity of 25 inch-pounds, the ratio is 1600 to 1. Other ratios furnished as specified.

Oman Self-Lubricating Bearing Metal

Self-lubricating bearings which can not score or in any manner damage a steel shaft or journal can now be made from Oman Metal, according to the manufacturer—Woodworkers' Tool Works, 224 S. Jefferson St., Chicago, Ill. The metal is recommended for use in the making of all kinds of bushings, bear-

ings, slides, gibbs, and so on.

Oman Metal is said to be actual copper matte, the interstices of which are filled with amorphous virgin lead. The copper and lead can be used in desired proportion inasmuch as the characteristic structure is altered dimensionally, in direct relation to proportioning of the two metals. It is stated that lubricant can not be excluded from the load side of an Oman bearing while the shaft is at rest. The inherent lubricant in Oman Metal is always present at all points of contact and clings tenaciously to both bearing and shaft. Oman metal is easily machined and no cutting lubricant need be used as the inherent lubricating characteristics of the metal serve this purpose.

Airco DB No. 10 Radiograph

The Air Reduction Sales Company, East 42nd St., New York, N. Y., has added to their line of gas cutting machines the new light-weight No. 10 radiograph illustrated herewith.

The No. 10 will cut bevels up to 90 deg. and needs no extra attachment for this type of work. Square edges and straight lines of any length desired can be produced and complete circles up to 85-in. diameter can be cut, using a radius rod and center point. Weighing only 41 lb., it is extremely portable and can be carried from job to job with no appreciable effort.

Included with the machine proper is the following, which comprise the standard equipment: Torch adjusting unit, standard Airco-DB machine cutting torch, torch wrench, 3-conductor power cord 25 ft. long, radius rod and center point, one length of track and one cutting tip as selected.

The No. 10 Radiograph embodies the outstanding features: (1) A cutting speed of from 4 to 60 in. per min.

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VARIOUS WIDTHS
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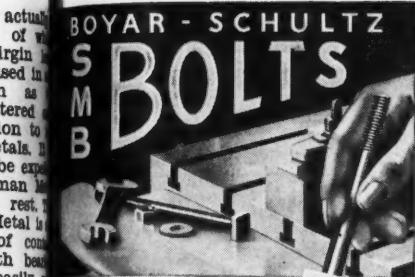
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AUGUST, 1938

SAVE THE JOB S-M-B Bolts permit delicate,
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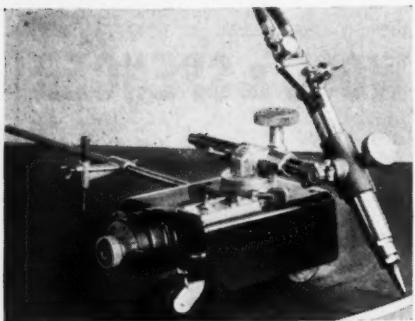
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Aireo DB No. 10 Radiograph

with modern indexed speed control for quick setting up and operation, (2) Free wheeling for easy lining up to the work, (3) Simplified horizontal and vertical torch adjustment, (4) All controls positioned for maximum convenience, (5) All working parts completely enclosed, and (6) Operation on 110 volt AC or DC.

Reed No. 501 Special Micrometer

Designed for use where the requirements are not as exacting as those for

which higher priced tools are used, the micrometer illustrated is now being marketed by Reed Small Tool Works, Dewey St., Worcester, Mass. The instrument is guaranteed to be accurate within 0.0005 in. and is designed for heavy wear.

The Reed No. 501 Micrometer is made in the 1-in. or 25 mm. capacity and plain or ratchet models only. The frame and barrel are die cast, the finish being black Japan. The steel spindle nut is locked in the barrel after being assembled on the spindle. The spindle and anvil are of tool steel with hardened measuring surfaces. An adjustment for correcting the setting is effected through a setscrew in the head of the thimble.



Reed No. 501 Special Micrometer

into which the spindle is threaded. Loosening the screw permits the thimble to be rotated on the spindle.

Graham Variable Speed Transmission

New models of the Graham Variable Speed Transmission with important additional features which broaden the scope and application of this type of equipment have been announced by Graham Transmissions, Inc., 2711 North 13th St., Milwaukee, Wisconsin.

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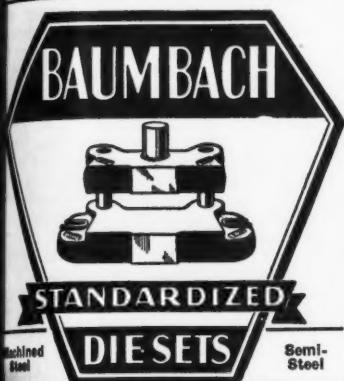
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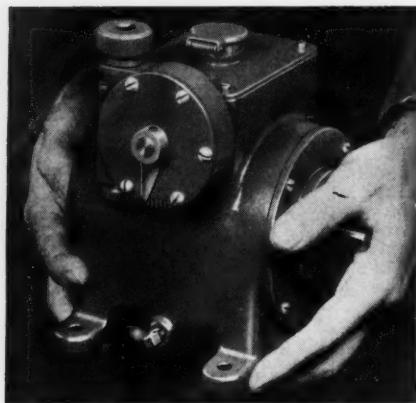
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drive pressure in proportion to both the load and the speed the Graham maintains full torque all the way to zero speeds. It transmits full motor power over a range of 4:1, and gives speeds in infinite steps from any desired maximum all the way to zero and reverse. Speed is adjustable, either stationary or running.

For applications requiring automatic



Graham Variable Speed Transmission

control with extremely close speed regulation, this transmission is especially advantageous. For drawing and winding fine wire—radio wire for example—it is possible with the Constant Power Graham to start the reel at the zero speed with controlled acceleration and avoid jerks and breakage of the wire. Full torque all the way to zero adapts the unit to difficult applications such as milling machine feeds, where extreme ranges of feed at full torque are needed.

The Graham Variable Speed Trans-

mission is based on the principle of a ring of fixed diameter in contact with conical rollers, the speed ratio depending on the ratio of the diameter of the ring to the diameter of the rollers at the point of contact.

The photograph illustrates the essential elements in the drive. Two conical rollers (D) are carried in the carrier (C) spaced 180 deg. apart. The ring (E) bears under pressure against the carrier (C) which surrounds the carrier. The position of (E) can be varied and by means of the control wheel (H), the carrier (C) is attached to the drive input shaft through the medium of a cam (B). The rollers (D) carry at their small ends pinions (F) which mesh with a ring gear (G) attached to the drive or output shaft.

In operation, as the shaft (A) rotates the cam transmits this rotation to the carrier (C) and at the same time applies a pressure to the ring which automatically conforms to the requirement of both the speed and the load. This pressure between the rollers and the ring causes the rollers to rotate about their own axes, and in turn to drive the output shaft through the pinions and gear (F and G). The ratio of the rotation of the rollers, and consequently the speed of the output shaft depends on the position of the carrier ring (E). The speed of the driven shaft is highest when the ring is in contact with the largest diameter of the carrier ring (E). The speed of the driven shaft is lowest when it is in contact with the smallest diameter.

The unique achievement in these models is the building up of the driving pressure to correspond simultaneously to the input torque and speed ratio. By this means just the required amount of pressure to transmit full motor power is at all times available over the operating range, while at the extremely low speeds the driving torque is held within limits, thus

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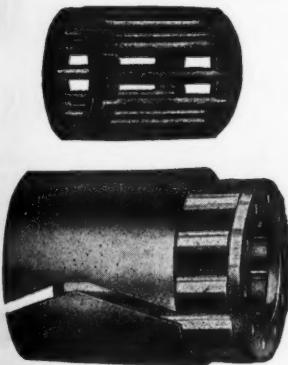
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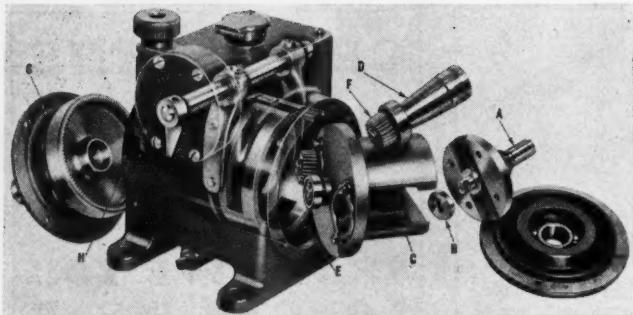
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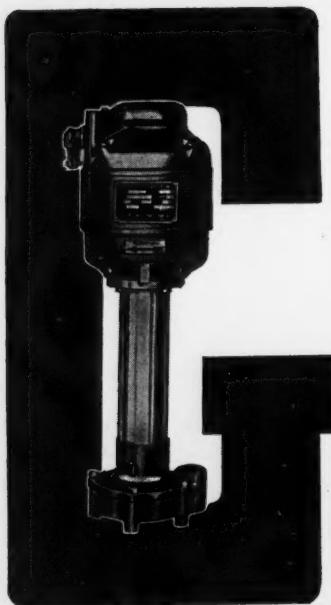


View of Disassembled Graham Variable Speed Transmission Showing Parts and Design

fording inbuilt overload protection. Speed is easily changed, either manually or automatically. The transmission comes either with motor built in or coupled. Made in two styles, either standard or with built-in gear—either reduction or step-up. Sizes are from 1/6 to 15 h.p. The small Model 25 shown in the photograph is only 5x8 in. overall and is said to be the smallest variable speed power unit of infinite range to zero ever built.

the recommended speed of 180 r.p.m. the Morse Variable Speed Control can be quickly adjusted by means of a hand set with visible dial to deliver any speed required from $1\frac{1}{2}$ to 40 r.p.m. through the low speed shaft. The unit has been satisfactorily adapted as a feeder drive and as a variable speed drive on a wide variety of mechanical units.

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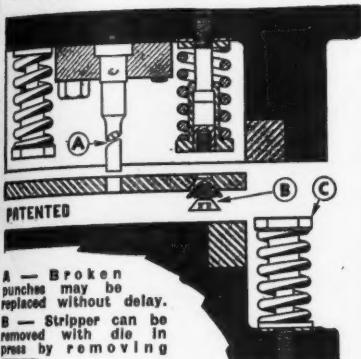
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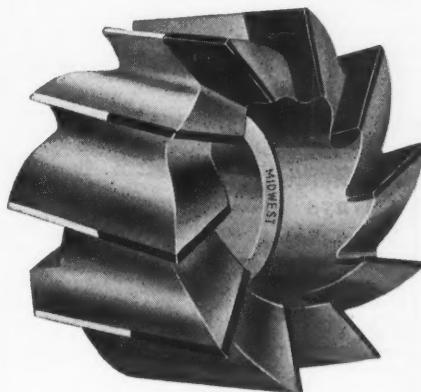
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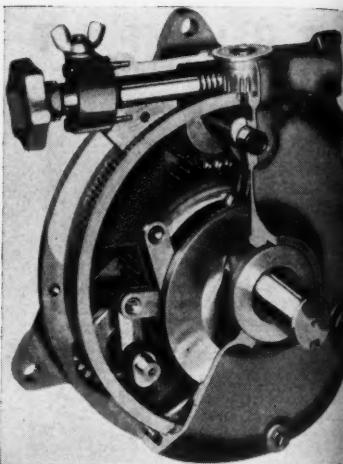
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bolts, nuts or parts inside the case which can become loosened. The unit is easily installed; installation involves coupling to the shaft and bolting on the machine frame by the use of three bolts. Right or left hand units are available.

The construction of the control unit is shown in the illustration. The input shaft is constructed with an integral cam of high grade carbon steel against which the hardened and ground alloy steel rollers operate. From the rollers the driving action is transmitted to the clutches through links which are connected with hardened pins and graphite



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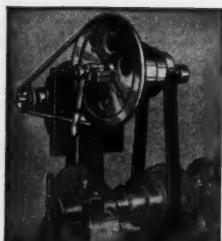
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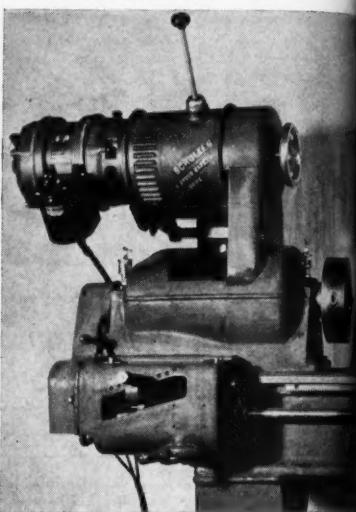
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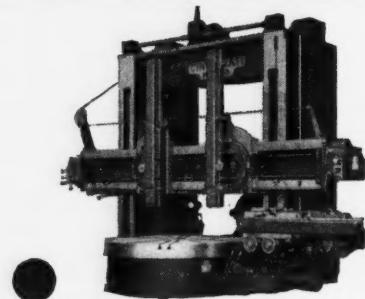


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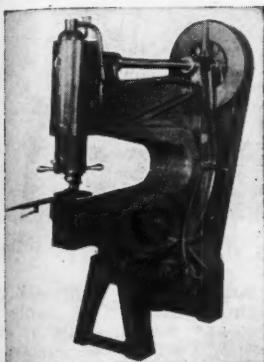
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Schultes Four-Speed Safety Motor Drive

is possible with all speeds. The motor is rigidly connected to the transmission housing and is coupled with a slotted keyed sleeve which reduces friction to the minimum. Ball and roller bearings are used throughout. Hardened steel ground gears and shafts operate in an oil bath in the sealed housing. Cradle adjustment permits the unit to be revolved to any desired position; thus the gear shift lever can be adjusted to any angle which is most convenient for the operator. The removable belt guard permits changing of pulleys. A rigid mounting arm or bracket is furnished with each unit and the unit can easily and quickly be attached to any type of machine. All units are reversible in the cradle for left or right hand drives. The Schultes unit is guaranteed and will be replaced within a year in case of defective parts or workmanship.

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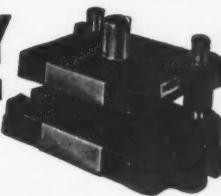
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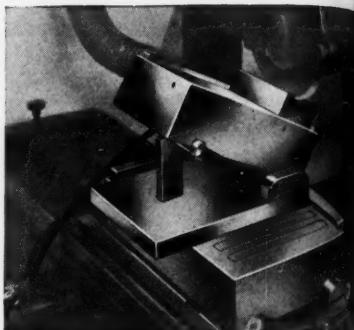
NEW YORK, N. Y.

British Associates—Mining & Chemical Products, Ltd., London, England

320, 385, 650 and 1200 r.p.m. at the high speed. Higher or lower ratios are available with different speed motors.

Universal Model Magne-Sine

A new model Magne-Sine, to be known as the Universal Model, has been added to the line of tools made by the Omer E. Robbins Company, 635 Mt. Elliott Ave., Detroit, Mich. The Universal Model differs only slightly from other single angle Magne-Sines, but is limited to use only with 110 volt current. In construction, the Universal Model consists of a



Universal Model Magne-Sine

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base plate to which is hinged the magnetic chuck table. This table may be tilted to any desired angle by employing gage blocks which are placed between the top of the base plate and a cylindrical bar which extends the full width of the hinged table on the underside. Having obtained the required angle, the workpiece is placed in position on the chuck table where it is magnetically clamped by a turn of the switch.

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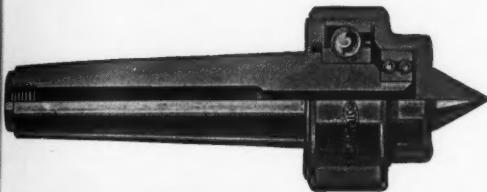
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August, 1938

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ORIGINATORS of the
Helical Taper Pin Reamer
Special Reaming Problems Invited
Immediate Shipment on Stock
Tools

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THE GAMMONS-HOLMAN CO. MANCHESTER, CONN.

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THERE'S NO BUSHING IN STOCK THAT WILL FIT THIS JIG

THAT'S EASY—GET IT FROM EX-CELL-O

ARE YOU CERTAIN THEY'LL HAVE IT?

SURE, THEY CARRY 3,240 DIFFERENT SIZES AND TYPES IN STOCK

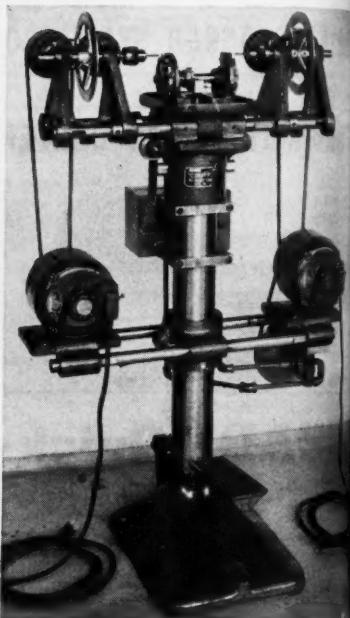
EX-CELL-O
DRILL JIG BUSHINGS
EX-CELL-O CORPORATION - DETROIT

CATALOG 534-B
ON REQUEST

tion. The machine is a product of Rickert-Shafer Co., Erie, Pa. As shown the machine is equipped with taps, the taps can be replaced with dies, external threading.

The machine is substantially built and is powered by two G-E motors, providing independent drives to the tap spindle.

The machine as shown is equipped with a fixture of the indexing type which can be loaded while the tap



Rickert-Shafer Double Opposed Spindle Boring and Drilling Machine

operation is proceeding. For certain types of work a magazine can be used, automatic feed provided so that all the operator needs to do is to keep magazine filled.

Oster Pipe Vise Stand

The Oster Manufacturing Co., 111 East 61st St., Cleveland, Ohio, has announced a pipe vise stand of the conventional type equipped with a power unit and chuck which enable the unit to thread, cut and ream by power sizes of pipe up to 2-in. inclusive.

The pipe is gripped in a universal bar-operated, scroll-type chuck and

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The Modern Air Gun

For blowing and cleaning purposes in machine shop, foundry, and factory.

A NEW MECHANICALLY-PERFECTED PRINCIPLE in AIR GUNS . . . Operating mechanism shielded within valve body and air hose . . . Streamlined with hose . . . Superconvenient to operate . . . Leakproof by virtue of no packing glands . . . Stocked in six standard sizes . . . Used by leading industrials.



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AIR-WAY PUMP & EQUIPMENT CO.
623 W. Jackson Blvd. Chicago, Ill.

August, 1938

NOW! Set Studs The Roll Grip Way



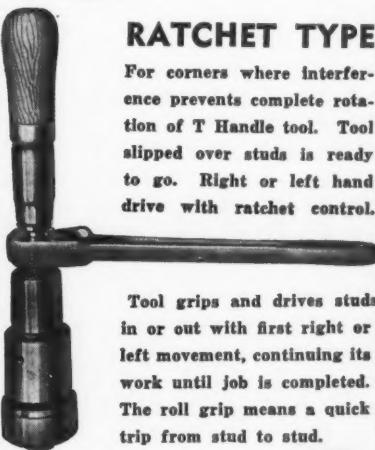
TITAN
STUD SETTER
"T" TYPE TOOL

Will Drive
Studs
or
Remove Them

Placed over stud to be set or removed. Slight left or right hand turn effects tight grip on stud. Release is just a matter of reversal accomplished in a split second.

RATCHET TYPE

For corners where interference prevents complete rotation of T Handle tool. Tool slipped over studs is ready to go. Right or left hand drive with ratchet control.



Tool grips and drives studs in or out with first right or left movement, continuing its work until job is completed. The roll grip means a quick trip from stud to stud.



The TITAN drives studs by gripping unthreaded body of stud. It drives studs having as little as $\frac{1}{2}$ " of gripping surface. Used as a POWER TOOL it may be driven by electric, air, or machine tool equipment. Write for details.

Manufactured under the
Kirkland Patent No. 2069527.

TITAN TOOL COMPANY
FAIRVIEW • PA.

Revolved by the power unit concealed in the upper part of the stand on which the pipe vise is usually mounted. The die-stock, cutter or reamer is placed on the pipe in the usual manner with the handles resting on sliding arms which are built in the sides of the stand. When the power is turned on, the sliding arms take the torque of the pipe tools as the threading, cutting-off and reaming operations are performed.

Power for the unit is furnished by a universal, variable speed Black & Decker motor, geared to the spindle holding the chuck, giving the chuck variable speeds



Oster Pipe Vise Stand

IDEAL SPEED LATHES



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Chucks. Hand
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25 years spent in serving the machine trade guarantees quality work and prompt service.

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COMPANY**
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from 14 to 32 r.p.m., according to the load or the cut. The motor can be connected to the ordinary 110 volt lighting circuit.

The legs of the stand are regular pipe of 1-in. diameter, giving it a height of 40 in. The width is 20 in. and the length overall, including carrying handles, is 30 in. Without the legs, which can be removed when carrying, the weight is only 110 lbs. so that two men can easily lift it on or off a truck when it is to be taken to a job.

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The quick acceptance by industry of the Fostoria Canopy Localite, utilizing silvered bowl lamps or clear lamps with

Industries select their Swiss pattern file requirements by this trade mark because it stands for Quality-Service



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Work. Holds files
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SERIES 174

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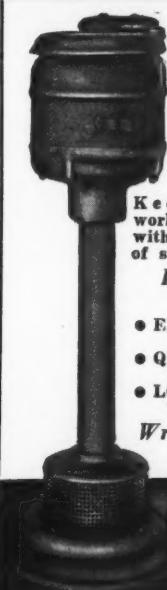
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PULLMORE CLUTCHES

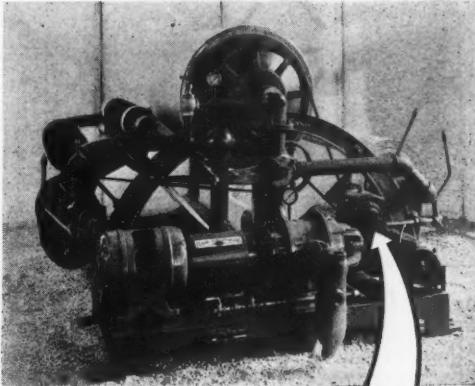
serve Dual Purposes
in Decating Machine

No. 4 double-type Pullmore Clutches, operating in oil, serve dual purposes in the Van Vlaanderen Decating Machine, illustrated. One side of each clutch is used for controlling the motor, the other as a brake. The manufacturers of this machine state: "Pullmore Clutches operate to the entire satisfaction of our customers and ourselves for their dependable quick action not only adds to the life of the machine but results in finer and faster production". The Van Vlaanderen Machine Company, "world's largest manufacturer of silk and rayon processing machinery", also uses Pullmore Clutches in other machines.

Pullmore Clutches engage smoothly, easily; operate efficiently over long periods without attention. Investigate. Write for the Pullmore Blue Book.

LOCKFORD DRILLING MACHINE DIVISION

Lock-Warner Corporation, 300 Catherine Street, Rockford, Illinois
and by MORSE CHAIN CO., Ithaca, N. Y. Offices in principal cities



Pullmore Clutches are made in single and double types, for operation in oil or dry, in capacities from 1 h.p. to 75 h.p. at 500 r.p.m.

Alzak cups, is responsible for the development of a new unit of similar character to be known as Model "WC". The new unit is 36 in. wide and is available in 2½-foot multiple lengths with a minimum of 5 ft. It accommodates either



Fostoria Canopy Localite

150 watt or 200 watt lamps—one socket to each 2½-ft. length.

According to the manufacturer—Fostoria Pressed Steel Corp., Fostoria, Ohio—the unit is highly efficient, delivering an average of 33 foot candles with two 150 watt lamps over an area of 4x6 ft. at a mounting height of 48 in. above the working surface. The illumination provided is of a highly diffused or shadowless quality. Inside finish for the reflecting surface is a special matte white baked enamel, while the outside finish is wrinkled grey baked enamel.

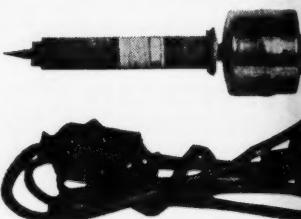


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HUDSON, N.Y.

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An electric marking tool with which letters, figures or characters can be marked permanently on metals of all kinds and on glass, wood or composition. It is now being marketed by Walls Corporation, 96 Warren St., New York, N.Y. This tool is said to be as simple to use as a pencil, and the marks made by the use of the tool are permanent. It is built to operate on 110 volt, 60 cycle A.C. current and can be used immediately upon plugging into any



Electric Engrav-rite

outlet and snapping on the switch can also be supplied for use with 110 volt, 25, 50 and 60 cycle A.C. current.



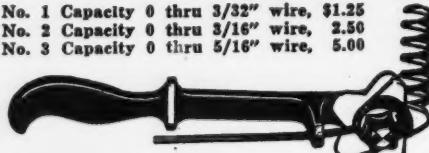
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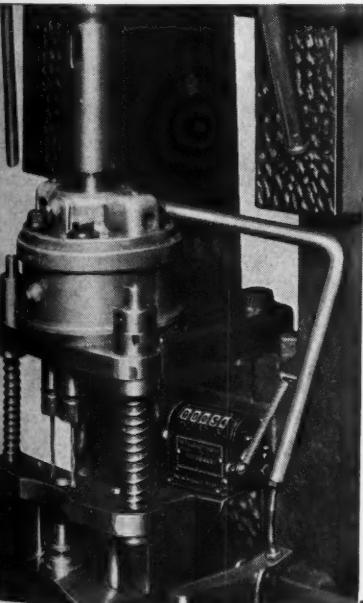
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Will give more production at less
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Work Fixture Counters Save Production Time

Small parts production on
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A Productimeter is easily con-
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the number of blanks drilled.

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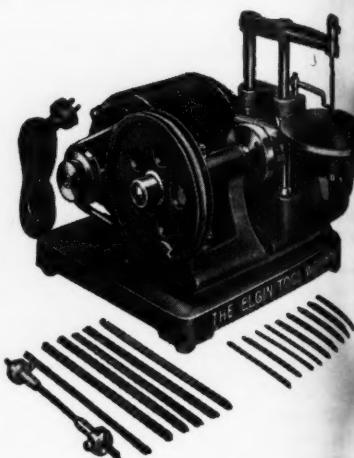
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The tool can be supplied with the ordinary point of the type that is usually used in an electric marking tool, or it can be supplied with a Carborite point, which is a specially developed material for marking on glass and other extremely hard materials.

Elgin Precision Bench Die Filing Machine

The Elgin Precision Bench Die Filing Machine shown in the illustration, which has been placed on the market by The Elgin Tool Works, Inc., 57 N. State St., Elgin, Ill., is intended for filing and

finishing small dies, templates, models and so on. The machine will handle



Elgin Precision Bench Die Filing Machine

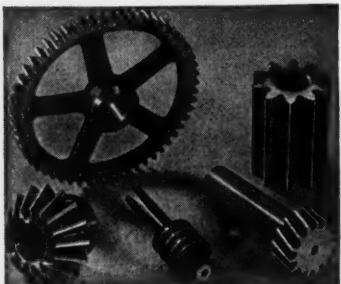
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Two Sizes

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No. 2 cuts up to $\frac{1}{4}$ " steel plate.
Special blades for shearing stainless steel.

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With Automatic Feed

Can be attached to Column Boring Bar and Drilling or Milling Machine spindles. Single point tool travels radially, from center outward or reverse, feeds automatically and covers faces 6° to 30°.

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for use in restricted quarters. Dial can be swung to any angle suitable to the operator.



Left — Vertical Type:
Clear view of dial when used in vertical position.



Right — Vertical 90° Type: Dial viewed from end of gage.

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volt, 60 cycle, one-phase motor is provided. All working parts are hardened and ground. Bench space required is 12x18 in.; weight, 75 pounds.

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A universal precision speed measuring instrument to be known as the O-Z Improved Hand Tachometer with fixed reading device is now being marketed by O. Zernickow Co., 15 Park Row, New York, N. Y. The instrument will show instantly, without the use of a stopwatch or other accessory, (a) the num-



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Acme Standard over 6700 Items
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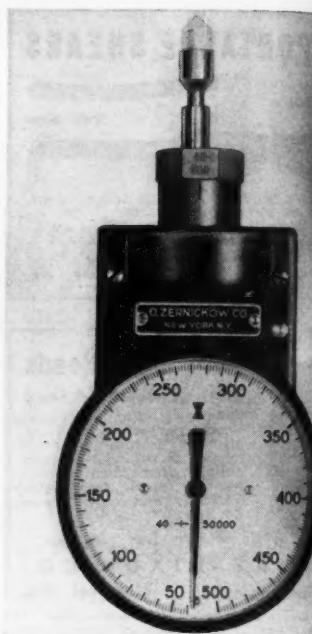


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COMPANY**
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O-Z Improved Tachometer

ber of revolutions per minute of revolving shaft, spindle or other revolving unit, (b) the surface or peripheral speeds in feet per minute of revolving objects such as pulleys, flywheels, etc., or workpieces in the lathe, planer, other machine, (c) speed variations, (d) belt slipping and consequent loss of power.

The total range of the instrument is 40 to 50,000 r.p.m. and 12 to 11,000 f.p.m. Three selective range steps are included; 40 to 500, 400 to 5000, and 4000 to 40,000 r.p.m. With standard

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We make
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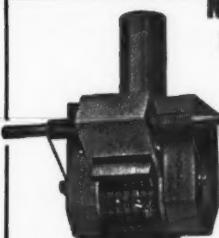


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meter wheel (standard equipment) this range becomes 12 to 150, 120 to 1500, and 1200 to 15,000 f.p.m. With special cutmeter wheel, the range becomes 20 to 250, 200 to 2500, or 2000 to 25,000 f.p.m. The one single scale handles all three ranges.

The dial is 2½-in. diameter. The housing is black enameled metal. The reading is controlled by a push button located at the front of the instrument and the accessories include one rubber point, one steel point, one funnel center, one thread, one cutmeter wheel, one 3-in. extension bar, and instruction card. The instrument is not affected by magnetic fields, electricity, or changes in temperature or moisture. The housing is dust and moisture-proof. Indications are guaranteed accurate within one-half of one per cent.

BOOKS

Psychology of Selecting Employees. By Donald A. Laird. 316 pages. 140 illustrations. Cloth binding. Published by McGraw-Hill Book Company, 330 West 42nd St., New York, N. Y. Price, \$4.00.

This book, which in the first and second editions bore the title "Psychology

of Selecting Men", incorporates numerous minor changes to bring the text up to date. Two chapters have been dropped and two entirely new chapters have been added. The purpose of the author is to set forth a technical account, in a technical way, of the fundamental considerations in selecting men. The portions of the book constitute a critical survey of traditional methods; the latter portions, a description of the scientific methods of selection.

The book is intended to formula-
the employer the principles to be
lled in the use of scientific methods
when selecting workers. According to
author, "Common sense, when it has
been schooled in the methods of
ence can not be considered a
uide in these matters." In other
there has been too much of the
"square pegs into round holes" in
past, and this book, written by the
who is considered the outstanding
thority in America on this subject,
intended to give the reader an
which will aid him in selecting
employees according to their fitness for
tasks involved.

Beginning with an explanation of
field and functions of employment
chology, the author explains the
and nature of individual differences
emphasizes his statements by the use
case studies and charts. The Let-
Application, the Interview, Chur-
Reading, Measuring Personality, The
and Use of Psychological Tests in Se-
lection are taken up in turn, carrying
reader on through Intelligence Test
Guiding Applicants, Emotional Mat-
and Job Adjustment, and then on
with a chapter on Interests, Spe-
Abilities and Education. The 18 chap-
and more than 140 illustrations
give the reader a very good grounding
the subject and will provide him
a basis upon which he can develop
own employment program.

"Artificial Light and Its Applications." Because of rapid advances made in the art and science of lighting during the past two years, and to provide a more up-to-the-minute light facts for the illuminating engineer, Westinghouse Lamp Division of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces a completely revised edition of its illuminating handbook which is available for seventy-five cents (\$.75) a copy.

Titled "Artificial Light and Its Ap-
plications," the new edition is larger
much more comprehensive than

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THE M-B COMBINED AUTOMATIC AIR LINE FILTER AND LUBRICATOR

First removes from 96-97% of water, dirt, scale, etc., in air line, then
delivers a mist of oil into the clean air going through the bearings
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Removes the guess work from the lubrication of air tools, smooths
tool operation, eliminates costly shut downs and lengthens tool life.

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M-B PRODUCTS 130 E. Larned St., Detroit, Mich.

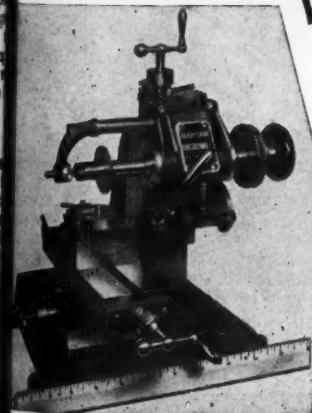
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Special features

Cutter, Spindle and Bearings, tool steel hardened and
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Optional Styles: Lever Cam Feed for Table Slide,
or Rack and Pinion Feed for both Headstock Slide,
and Table Slide. Table Slide adaptable to Headstock Slide
and of special type fixtures. Write for stand-
ard information.

SPECIFICATIONS MODEL 651

Vertical micrometer feed	44 m/m	1.73"
Vertical lever feed	25 m/m	.984"
Cross feed of table	32 m/m	1.26"
Longitudinal feed	80 m/m	3.15"
Maximum distance spindle to table	75 m/m	2.95"
Minimum distance spindle to table	10 m/m	.3937"
All feeds with micrometer adjustment to .001"		
Table 2 3/8" x 6 7/8" Base 7 1/2" x 8 1/2"		
Height to top of column is 8" Wt. 36 lbs. less fixture		
Model No. 943 countershaft, self oiling bronze bearings		
Special mount 1-5/16" diameter shaft		
Foot treadle operated		



F. W. DERBYSHIRE, INC. WALTHAM, MASSACHUSETTS, U. S. A.

former edition. Where the earlier edition contained but seven chapters, the new one contains 19, some of which are new, others of which are elaborations. Tables have been revised and the text has been simplified and profusely illustrated. Among the new chapters are those on Photometry, Color, Theatre Lighting, and Sports and Recreational Lighting.

Stressing the important part artificial lighting plays in eyesight conservation, space is devoted to the physiology of the eye and its reaction to light. The

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Everyone recognizes "fever" but the important thing is exactly "HOW HOT". It's the same with heat treating, metal melting, and tempering. Guesswork is certain to fail sometime. Know your temperatures. End needless waste, and excessive spoilage with a Hold-Heat Pyrometer.

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Shipped prepaid to rated firms
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- Air Conditioned Dining Rooms
- Ample Parking Space
- Rates from \$3.50

Write for historical map of Boston.
L. E. WITNEY, Managing Director

application of lighting in industry, commerce, and the home is fully treated.

The book is a record of facts valuable to the experienced engineer for reference and to the beginner as a textbook. It is 8½ x 11 in. in size and contains 128 pages. Copies may be obtained from the district or branch office of the Westinghouse Lamp Division, Westinghouse Electric & Manufacturing Company.

"Homo Method for Nitriding." Heat treaters using the Homo Method are now nitriding tools and production parts exacting specifications, with cases uniformly hard, uniformly deep, according to statements made in "Homo Method for Nitriding," a 16-page catalog issued by the Leeds & Northrup Company, 1000 Stenton Ave., Philadelphia, Pa. Fully illustrated, the publication includes graphs showing the effects of time and temperature on surface hardness and case depth. A novel photograph reveals how the forced-convection principle, applied in a furnace especially for nitriding, makes possible highly uniform case hardening. Numerous photographs show the equipment in actual use, illustrating what is said to be fundamental simplicity of operation, convenience of maintenance, and ease of installation.

A copy of "Homo Method of Nitriding" will be sent promptly to anyone interested. Address Leeds & Northrup Company at the above address.

Gorton 1938 Instruction Book and Parts Catalog for All Pantograph Machines. The purpose of this 40-page book is to give briefly the information necessary for getting Gorton Pantograph Machines ready for use, avoiding possible injury to delicate parts. Directions for

Hotel Kenmore

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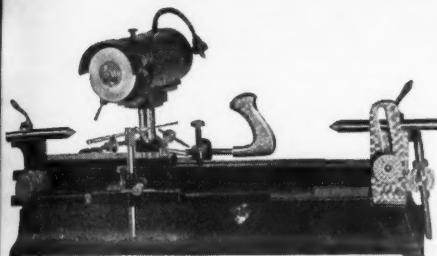
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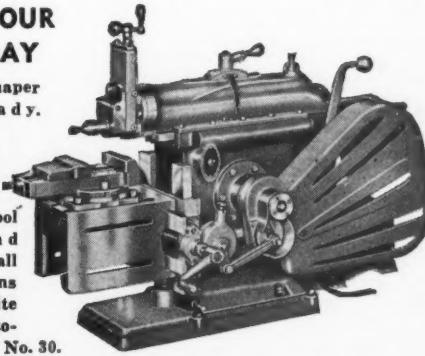
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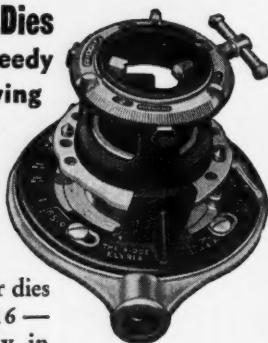


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Dahlstrom Metal Mouldings and Shapes. Dahlstrom Metallic Door Co., Jamestown, N. Y., has issued a catalog of interest to manufacturers who fabricate sheet metal parts.



cate or assemble sheet metal parts products. The catalog contains 167 pages profusely illustrated with actual section drawings of the innumerable shapes produced by this company for practically all of the commonly-used metals. The simplified indexing and arrangement by which the catalog is tabularized under logical classification will appeal to busy plant executives.

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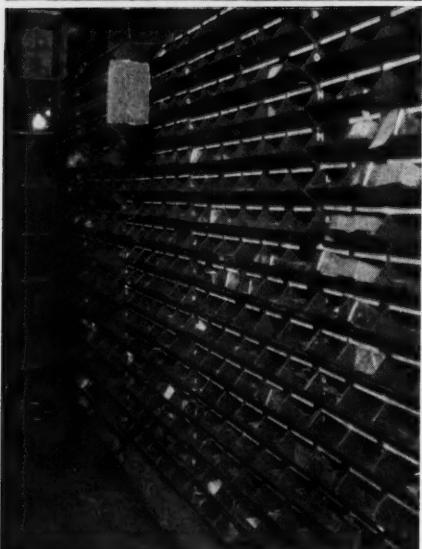
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Line, 60 to 4500-lb. roller capacity; Precision Tapered Roller Bearing Line, 1000 to 12,000-lb. roller capacity; the Precision Ball Bearing Line, 1000 to 8000-lb. roller capacity. It is said to be the first "Engineers' Hand Book" on roller conveyor and includes bearing capacity, roller deflection and roller selection charts to enable the user to make a balanced selection of bearing, frame and frame rail. Copy free upon request.

Landis 16-In. Type D Hydraulic Pin Grinder is the subject of Catalog N-38, a publication of Landis Tool Company, Waynesboro, Pa. The grinder is a highly refined and massive proportioned machine for the rapid production grinding of crank pins, making possible the grinding of all the pins on any crankshaft on one machine without one handling of the work. Catalog N-38 gives complete details covering construction and operation of the grinder, and is well illustrated throughout.

Copy free upon request.

"It Fastens As It Taps" is the title of a folder describing Type "T" and Type "S" Groov-Screws, which are hardened screws with multiple cutting edges and grooves. The Type "T" has spiral grooves over the entire length of the thread shank, thus providing sufficient area for adequate chip removal. The Type "S", which the spiral grooves extend only a portion of the shank, is especially recommended for applications where excess vibration is a factor. Copy free upon request. Addressing Groov-Pin Corporation, 13 Kerrigan Ave., Union City, New Jersey.

B & S Dual Control and Standard Type Milling Machines. The features and advantages of these machines are outlined in an attractive 40-page catalog now being distributed by Brown-Sharpie Mfg. Co., Providence, R. I. Various models are illustrated and described. One section is devoted to attachments which are available for these machines. Copy free upon request.

Flame Cutting Service. A profitably illustrated bulletin showing the wide range of products burned from rolled steel plates by modern flame cutting methods is now being distributed by Joseph T. Ryerson & Son, Inc., Chicago, Ill. Copy free upon request.

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Copy of Catalog M.L. 11 free upon request.

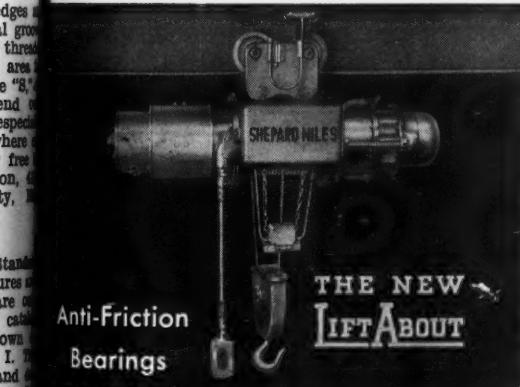
Cincinnati Vertical Hydro-Tel Milling Machine, Catalog No. M-796. This 24-page booklet is devoted to the Cincinnati Vertical Hydro-Tel Milling Machine, a product of the Cincinnati Milling Machine Company, Cincinnati, Ohio, which is well adapted for both conventional milling and die sinking. Maximum rigidity of structure, efficient spindle drive, easy manipulation, and independent and non-related feed rates to cutter and work slides are features of the machine.

Catalog No. M-796 contains descriptions and illustrations of the machine and of the various attachments for it. Copy free upon request.

Johnson Friction Clutches. The standard type of friction clutch with metal-to-metal frictions is discussed in a catalog published by The Carlyle Johnson Machine Co., 52 Main St., Manchester, Conn. Also included is a description of the Super-Johnson Type Clutch with Raybestos-faced expansion rings. This clutch runs dry where such a method of driving is required. Specifications and prices are listed. Copy free upon request.

Beryllium Copper Safety Tools. In this four-page folder, The Beryllium Corporation of Pennsylvania, Reading, Pa., presents the advantages and features of Beryco Safety Tools. Copy free upon request.

"Dust Control by Sly" is the title of a 24-page booklet, designated as Bulletin No. 90, now being issued by The W. W. Sly Manufacturing Co., 4700 Train Ave., Cleveland, Ohio. The booklet gives an extensive resume of Sly cloth type filters, discusses their application to many dust control problems, and gives other general information concerning dust control equipment and installations. Numerous installation photographs are featured. Copy free upon request to the advertising department of the above company.



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"Facts About Stanley Electric Screw Drivers," a publication of Stanley Electric Tool Division, The Stanley Works, New Britain, Conn., tells where and why these screw drivers are used in industrial plants, and describes the different types of Stanley Electric Screw Drivers and the accessories used with them. Copy free upon request.

Hy-Draulic Slotter. This four-page circular presents the features and advantages of the Hy-Draulic Slotter recently placed on the market by the Rockford Machine Tool Co., Rockford, Ill. The

slotter, which has a 20-in. rating and 36-in. stroke, is said to provide increased production, easy operation, superior finish, long tool life and low costs on a wide variety of highly accurate work. Copy free upon request.

Spencer $\frac{3}{4}$ H.P. Industrial Portable Vacuum Cleaner is the subject of Bulletin No. 112 now being issued by The Spencer Turbine Company, Hartford, Conn. According to the manufacturer, the cleaner has a multi-stage vacuum producer, adequate dirt capacity, is easily cleaned, and is designed exclusively for industrial service. Copy free upon request.

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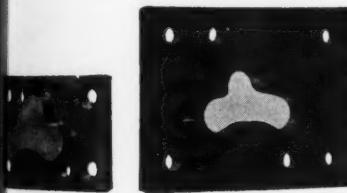
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"Air Conditioning for Lower Welding Costs" is the title of a folder which describes and illustrates a number of applications of the Linconditioner, a product of The Lincoln Electric Co., Cleveland, Ohio. The Linconditioner filters the smoke and removes the fumes of welding operations, thereby contributing materially to the efficiency of workmen and the improvement of working conditions generally. Copy free.

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R-4	3/8	5.00	1/4	1	4
R-5	1/2	5.50	3/8	1 1/4	6
R-6	5/8	6.50	3/8	1 1/4	6
R-7	3/4	8.00	3/8	1 1/4	6
R-8	7/8	9.50	7/16	1 1/4	6
R-9	1	12.00	7/16	1 1/4	6
R-10	1 1/4	15.00	7/16	1 1/4	6
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Here at last, is a drill that is especially designed for drilling any and all kinds of non-metallic materials . . . a drill with a special patented Carbide Tip that gives far greater cutting power . . . a Drill that actually gives 75% greater drilling speed and without the use of any outside cooling agent either . . . a Drill that's built to stand up under the hardest possible working conditions . . . a Drill that will outlast dozens of the ordinary old type star drills . . . a Drill that can be used in any portable drill, hand brace or drill press at any r. p. m. Can be sharpened on any type of standard grinder with any make of grinding wheel.

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To obtain copies of the catalogs listed here, indicate on the coupon the number of the item in which you are interested and mail as directed.

1. **Shaper**
Atlas Press Co., 746 N. Pitcher St., Kalamazoo, Mich., has issued a new 8-page Catalog No. 30 which completely describes and illustrates the new Atlas Shaper.
2. **Universal Grinding Machines**
A new bulletin, G-414, which illustrates and details the New 12" and 16" Cincinnati Universal Grinding Machines, has been issued by Cincinnati Grinders Incorporated, Cincinnati, Ohio.
3. **Flame Cutting**
Joseph T. Ryerson & Son, Inc., with offices in principal cities, has published a new 4-page bulletin showing typical applications of Ryerson Flame Cutting Service.
4. **Universal Grinders**
Catalog J-138, featuring Landis 12" Type-C Hydraulic Universal Grinders has just been released by Landis Tool Co., Waynesboro, Pa.
5. **Free Cutting Steel**
Inland Steel Co., 38 South Dearborn St., Chicago, Ill., now has available a bulletin announcing Inland Ledloy, the new lead-bearing open hearth free cutting steel.
6. **Oilless Bronze Bearings**
Metaline Oilless Bronze Bearings are classified and illustrated in a 4-page folder published by R. W. Rhoades Metaline Co., Inc., Long Island, N. Y.
7. **Motor-Starting Switch**
Features of the General Electric Manual Motor-starting Switch for control of fractional-horsepower motors are reviewed in bulletin CR1061. General Electric Co., Schenectady, N. Y.
8. **Graph Sheets**
Keuffel & Esser Co., 127 Fulton New York, N. Y., have published 88-page catalog on graph sheet coordinate papers and cloths.
9. **Metallographic Equipment**
Catalog E-225, featuring metallographic equipment and accessories has just been released by Baile Lomb Optical Co., Rochester, N. Y.
10. **Arc Welder**
A new 6-page folder illustrating and describing the New Hobart Range Arc Welder is available from Hobart Brothers Co., Troy, Ohio.
11. **Plain Grinding Machines**
Nos. 20 and 22 B & S Plain Grinding Machines are detailed in a 8-page folder issued by Brown-Sharpie Mfg. Co., Providence, R. I.
12. **Precision Boring Machines**
The Stokerunit Corporation, 450 Mitchell St., Milwaukee, Wis., issued an 8-page bulletin on Precision Boring Machines.
13. **Roller Bearings**
Bulletin No. 14 released by The Timken Company, Fairfield, Conn., gives complete specifications and engineering data on Heim self-contained roller bearings for all radial installations.
14. **Hole Gage**
Bulletin 25 illustrates and describes the Comitorplug for producing gaging of holes to close tolerance. The Comtor Co., Waltham, Mass.
15. **Block Type Boring Equipment**
Bulletin No. 300 illustrates and describes the Block Type Boring Equipment manufactured by Davis Boring Tool Co., 6200 May Ave., St. Louis, Mo.